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NATIONAL ELECTRIC LIGHT CONVENTION.

Supplementing the report given in these pages last week, of the first day's proceedings of the National Electric Light Association meeting in Chicago, we now devote several pages of the present issue to the work of the convention during the rest of the week. It is almost needless to repeat our comments upon the great success which has attended this latest visit of the body to Chicago. Whatever dead wood there was in the Association—and undoubtedly some had accumulated—it has evidently all been cut away, for never in the history of the Association was there a larger or more enthusiastic gathering, or one at which a larger amount of useful work was accomplished. The most gratifying aspect of the situation is that while the big companies remain in membership, and naturally supply the incumbents of the presidency, large numbers of the smaller companies are coming in, occupying the other offices, attending the meetings, giving a distinct stamp to the proceedings, and deriving a large amount of good from what is done. Indeed, it must be obvious to any one who studies the conditions of things that the best hopes of the Association lie not so much in holding together the few larger companies which do a considerable portion of the electric light and power business, but in enlisting the sympathy and active support of the smaller companies throughout the country. If we take fifteen or twenty of the largest companies, it will be found that they are systems presenting a remarkable sameness in the questions that arise in regard to them, and that these problems are more or less specifically limited to this score of corporations. On the other hand, the three thousand relatively small companies, also doing in the aggregate a large proportion of the production and distribution of current, present a greater variety of aspects and difficulties for consideration, and it is evident that further increase in membership of any magnitude must be looked for among them. The Association does well, therefore, not merely to place representatives of the minor companies among its officers, but to put upon its programme papers and discussions directly affecting their interests. Indeed, it might be said that the Question Box, and the new Committee on Progress, have both been developed with special reference to the wants of the smaller companies whose activity and welfare are stimulated by a study of the advances being made in the art, and by an interchange of practice and experience in regard to the newer problems that arise.

The growth in membership during the past year is, indeed, one of the most hopeful features connected with the work of the Association. It thus gets into touch with a larger area, and becomes more a representative body with the right to express opinions with greater validity when it addresses public sentiment. But, while encouraged by this rapid growth of the past year, the officers ought not to rest, but to push their propaganda, so that instead of claiming five hundred members they can point proudly to at least a thousand. Even then they will have but thirty per cent. of the possible; but that will be a good proportion, and while enhancing the influence and reputation of the Association will give it the resources wherewith to take up the work which it has not yet attempted, but which the industry is entitled to expect of it. Some of this newer work was indicated in the presidential address of Mr. Ferguson, and it is easy to suggest other lines. As to the new president, Mr. Edgar, it can only be said that, like his talented predecessor, Mr. Ferguson, he is eminently qualified to fill the chair, and that both, like Mr.

Doherty, are remarkable representatives of the younger element in the electric light profession. When we remember how hostile and antagonistic the Edison contingent was at one time toward the National Electric Light Association, it is a sign of the best augury thus to find Edison men welcomed to the ranks of the Association and given also its highest places of honor.

We have sometimes heard cynical and skeptical people wonder what good conventions are; but we are sure that not one who attended the meeting last week in Chicago will have ventured to raise such a doubt, or even to entertain it. The crowded attendance at each of the business sessions was a most happy indication of the deep interest taken by the central station men in the vital questions affecting their prosperity; and altogether the bearing and behavior of this vast concourse of nearly a thousand people was the best possible evidence of the dying out of the old spirit of junket, and the broadening and deepening of the ideals that must govern the future of an industry now making so good an impress upon the social life of the United States.

LOST CURRENT.

We hope that many a station manager will take to heart the curious facts brought out in Mr. Van Ness's convention paper. The sins of the early alternating-current systems in the matter of lost energy are well known, and from all appearances the case even now is none too good. In the good old times when everybody used 50-volt lamps and at least one transformer for every customer, it was a wonder that enough current to keep the station out of bankruptcy was ever sold, and unless our memory plays us false it frequently was not. We should really like to see an authentic record of the lost current in some of these old-time plants. Certainly, in some cases, the energy actually paid for by the consumers was no more than twenty-five or thirty per cent. of the total generated. But who knows how much lower it may have fallen? To pass from these prehistoric times to the present, Mr. Van Ness cites one circuit in operation until very recently in which the sales were only 48.5 per cent. of the energy, and it is safe to say that there are scores of instances quite as bad. In this particular circuit most of the waste was very easily accounted for, and was found in the transformer core losses as usual. The resistance losses were small, the meter losses were insignificant, and the energy unaccounted for was practically none; that is, it was well within the range of experimental errors. A comparison of this circuit with another from the same table affords some startling facts. The house-to-house transformer system, although having the advantage of some commercial work, showed only 2.4 kilowatts of load connected, and 0.6 kilowatt of maximum demand per transformer connected. The average capacity of the transformers was 1.1 kilowatt, and under the circumstances it is small wonder that nearly half the output went to settle the core loss account. Such a circuit seems hopelessly out of date.

The modern three-wire circuit with which it was compared showed the advantages of a secondary main system in the most striking fashion. The connected load was 31 kilowatts, and the maximum demand 5.4 kilowatts per transformer of 9 kilowatts average capacity. Still, with all this improvement the percentage of energy sold was only 71.2. More than half of the loss was due to core loss in the transformers, and over 5 per cent. of the total energy was wasted in the meters. Both these items seem needlessly large. It certainly appears to be wasteful metering that uses up *seven per cent.* of the energy sold, and it is certain, as Mr. Van Ness shows in the figures from another circuit, that this figure can be reduced by careful engineering to less than one per cent. But the core loss is still with us and there seems small prospect that it can be greatly reduced by direct improvements in the transformers. It can, however, be very greatly reduced by skill in arranging the system, and nothing is more clearly shown in Mr. Van Ness's paper than the effect of attention to details upon station economy. If an electric manufacturing company brought out a transformer with less than a quarter the usual core loss, the racket would be heard around the world, yet here before us is a case where just this result was reached by *finesse* in arranging a feeder circuit. The need of skilled supervision of details is obvious.

ARCS OF LOW AMPERAGE.

Street lighting seems just now to be that branch of central station work which is subject to the most rapid and striking change. The old arc machine held the field undisturbed for a long time, but when the change began it progressed with most astonishing rapidity. Mr. Hallberg's paper on some of the recent work in Cincinnati displays the trend of recent practice admirably. There is no doubt that the tendency to use more and smaller lights is a growing one, and that in the main the movement is in the right direction. There obviously comes a point in subdivision at which it ceases to be advisable, and it is always an interesting matter to determine this point, which, of course, varies with different illuminants. We must confess to some doubts as to the wisdom of working series alternating enclosed arcs with a current as low as four amperes. It would be very interesting to know the mean spherical candle-power and the distribution curve from Mr. Hallberg's lamps, without which the comparison with other illuminants loses much of its force. The old "2,000-candle-power" open arc gave a vile distribution of light and generally flickered abominably, but it did give very strong illumination at a good luminous efficiency, and it gave white light. It seems to us that most of the practical gain in the modern arcs, from the standpoint of the public, comes from the very great increase in steadiness, and the absence of an abnormally bright zone near the lamp. The low-ampere alternating arcs give a light which is not yet satisfactory, and we cannot avoid the impression that they may represent only a temporary phase in street illumination, unless the color difficulty can be permanently overcome. The system of constant-current transformers seems to work admirably and the increase in plant efficiency over the older arc systems is very marked. And yet it seems like a makeshift to generate and transform the energy in the same building. It is, indeed, a pity that the constant-current transformers cannot be distributed as other transformers are. Such distribution is, indeed, practiced now and then, but the general opinion of station managers seems to be against it.

The whole business of street lighting seems to be in a transitional stage, and one constantly wonders what will be the outcome. We would like to see a careful comparison between the various systems of electric street lighting, based not on distribution and operating expenses alone, but on the watts per mean candle-foot at the areas to be illuminated. Something is certainly to be hoped from the new illuminants now being pushed into use. It would be interesting, for example, to get authentic figures from Nernst lamps used on the streets and from the mercury arcs as well. The latter arc is, it is true, most weird in color, but not more so than the low alternating-current arcs, and being capable of use with clear shades on account of their lower intrinsic brilliancy, should give a pretty good result in efficiency. Then, too, there are some modified arcs yet to hear from, and altogether the outlook is varied. It is a far easier task to devise a light for the street than for the house on account of the less severe requirements as to intensity, color and steadiness, but there is plenty of room for improvements still. But even so, it is a large gain from the sputtering, clattering, glaring arcs of the early eighties to the enclosed arc used on our streets to-day.

THE HEYLAND MOTOR AND GENERATOR.

Much has been said and written during the past year concerning the possibilities of the Heyland improved induction motor, but the first reliable tests of this machine published in America appear in Prof. Adams' paper read at the last meeting of the American Institute of Electrical Engineers. As most of our readers are aware, the Heyland motor is an improvement upon the ordinary polyphase induction motor, and is designed to get rid of the relatively powerful wattless or magnetizing primary current of the machine. A commutator, with or without a special winding, is mounted on the rotor secondary of the machine, and polyphase currents, either from taps in the primary star winding or from a compensator connected to the primary terminals, are supplied to the stationary brushes. With suitable adjustment of the brushes and of the voltages applied to them, the power factor of the motor while running can be brought up to nearly unity, or one hundred per cent. The particular Heyland motor tested by Prof. Adams was a 10-hp, 6-pole, 60-cycle, three-phase machine constructed in this country.

When an induction motor is operated at synchronous speed, or the speed which the rotor very nearly attains when unloaded, the current supplied to the motor at primary terminals is an appreciable fraction of the full-load current, whereas the current supplied to a direct-current motor unloaded is a much smaller fraction of the full-load current. This induction motor current at light load is mainly a magnetizing current, serving to develop the rotating magnetic field of the machine and corresponding to what is called the exciting current, or leakage current, of a transformer on open secondary circuit. The exciting current of an ordinary transformer with closed magnetic circuit is a very small fraction of the full-load current, so that the wattless component of current in a transformer is of little practical importance. But the magnetic circuit of an induction motor cannot be closed, since the mechanical clearance between stator and rotor necessarily introduces two air-gaps in series. Consequently, the magnetizing current and the wattless component of the current under ordinary load is of considerable practical importance. In the motor tested by Prof. Adams, without the use of the commutator currents, i. e., in the condition of the ordinary induction motor, the current at full load was 14 amperes per line, and at no load 6 amperes per line, or nearly 43 per cent. of the full load current. The power factor of the current at no load was 20 per cent., and at full load 86 per cent. When the commutator was brought into action, the full-load current per line was reduced to about 12¼ amperes, and the no-load current to about 2 amperes, or to about 16 per cent. of the full-load current, while the corresponding power factors at full load and no load were about 99 per cent. and 65 per cent., respectively.

The preceding figures seem to present the salient advantages of the Heyland motor. The result may be summed up by stating that the current supplied to the motor from the mains and central station can be materially reduced during the full-speed running of the motor, but without sensible change of the input or efficiency. The reduction in current at no load may be about 66 per cent., and at full load about 12 per cent. For average running conditions under variable loads, the average current reduction might be, say, 20 per cent., since induction motors are not usually operated at relatively small loads. The basis of the method adopted in the Heyland motor is that when polyphase currents are admitted to a motor winding through fixed points, the rotating magnetic flux thereby set up, cuts the loops in the winding and generates a relatively large reactive voltage; whereas, if the same currents are admitted to the winding through properly adjusted brushes on a commutator, and the brushes are revolved backwards at synchronous speed, the rotating magnetic field will be pulled back by the brushes at the same speed at which it advances with respect to them, so that the field will be stationary in space and in the winding, thereby cutting no loops and generating no reactive e.m.f. Similarly, if the armature be rotated at synchronism with the brushes at rest, the field will not rotate in space, as before, but will still be at rest with respect to the reactive e.m.f. A comparatively small alternating voltage applied in this manner through properly disposed brushes will, therefore, produce a relatively powerful working current in the motor winding, having only the ohmic resistance to overcome, and may produce the same rotating magnetic field as a displaced or wattless component of current at the greatly increased pressure necessary to overcome the reactance of the winding.

The Heyland motor may then be stated at its best, when it is regarded as receiving its exciting current from a local commutator exciter, only the energy of this excitation being supplied from the mains, while the wattless component of primary current is thus in large measure suppressed. This undoubtedly enables one objection against the induction motor to be removed. The other principal objection, namely, feeble starting torque per ampere, remains practically unaltered. An induction motor in which the field exciting current was absolutely zero under all conditions would still have a large reactance in the secondary winding at starting, a corresponding large secondary phase displacement of current, and a feeble torque per ampere of secondary current. A relatively large primary current strength would still be required to develop full load torque in the motor. Consequently, the advantage of the Heyland device would be less apparent with induction motors that were frequently stopped and started, than with motors that ran continuously near full speed. In the latter case the current saved in each motor might, perhaps, be 20 per cent. In the former case it might not amount to 10 per cent. The Heyland device does not appreciably improve the condition of the motor at starting. The question then rises whether the reduction in line current effected by the Heyland method of field excitation is worth introducing the extra complication of the commutator and brushes. The saving in line current is mainly an advantage to the central station manager. The bills for watt-hours consumed presented to the consumer would be about the same whether the Heyland device were used or not. The only reduction in expense to the consumer would be by the indirect advantage of such reduction in copper and generator plant as might enable the central station to lessen the cost and selling price of production. On the other hand, a commutator induction motor is necessarily a more expensive motor than the exciting commutatorless machine. Theoretically, it might be possible to use a larger clearance between stator and rotor in the Heyland motor, and thus reduce the cost of manufacture by eliminating some of the refinements in construction; but it seems doubtful whether such an attempt could succeed in paying for the commutator and brushes.

A considerable portion of this interesting paper is devoted to the consideration of the Heyland machine converted into a generator being driven by power with negative slip, or above synchronism. The machine under test maintained its terminal voltage nearly constant up to full non-inductive load output, running self-excited by its commutator. This is a valuable achievement for the Heyland machine, since such generators are asynchronous, and can be thrown together in parallel without difficulty. But even here there are difficulties to be overcome in order to compete with existing generators under commercial conditions. Prof. Adams' paper is a most valuable contribution to a subject which has been much agitated, and which needed just such careful experimental data to be compiled and published, in order to arrive at an adequate conclusion.

Independent Telephone Convention.

Mr. J. B. Ware, the secretary of the Independent Telephone Association of the United States, writes us as follows: "Nearly all on the programme have accepted the invitation to participate in our convention so that the changes hereafter will be very slight. Every indication at present is that the programme will be exceedingly interesting and profitable one to those in attendance, and that the local committee comprising the leading manufacturers have prepared an entertainment which will be enjoyed by all who are in attendance. We see no reason why the attendance should not be large and the meeting one of our most successful ones. Perhaps special interest will center around the report of the patent litigation committee which so ably and successfully looked after the interests of the independent companies in the famous Berliner and Carty patent suits."

A local committee, with Mr. J. G. Ihmsen as chairman, has already been formed in Chicago and is working to make the convention a great success. The preliminary programme is as follows: June 24, 2 P. M.—Address of welcome by Hon. Carter H. Harrison, Mayor of Chicago; response by Hon. S. P. Sheerin, of Indianapolis, Ind.; annual address of President James M. Thomas; roll call of States, ten-minute reports; "Advantages of Association," by Hon. C. E. Hull, of Salem, Ill., president Interstate Telephone Association; "The Telephone and the Technical School," J. C. Kelsey, professor of telephony, Purdue University, Lafayette, Ind.; "Modern Exchange Construction," W. H. Johnson, general superintendent Frontier Telephone Company, Buffalo, N. Y.; "Independent Telephone Development in the South," by C. E. Stinson, president Memphis Telephone Company, Memphis, Tenn.; "Western Telephone Development," J. S. Bellamy, Knoxville, Iowa. 6 P. M., concert in Auditorium Hotel. 8 P. M., special train to San Souci Park; programme of entertainment there to be given later. June 25, 10 A. M.—Patent Litigation Committee report, Hon. Hugh Dougherty, of Bluffton, Ind., chairman; "Telephone Discipline," by C. E. Tarte, general manager Citizens' Telephone Company, Grand Rapids, Mich.; "Eastern Telephone Development," F. A. Demarest, general superintendent Interstate Telephone & Telegraph Company, Trenton, N. J.; "Present and Future," Frank L. Beam, Columbus, Ohio; General business; election of officers.

Wireless Telegraphy and the Cable.

From time to time, the effect of wireless telegraphy on submarine cable interests has been discussed in these pages, and it is now interesting to note the latest comments on the subject. At the half-yearly meeting of the Eastern Extension, Australasia, and China Telegraph Company, Sir J. Wolfe-Barry, said that the shareholders were aware that the agreements entered into with certain of the Australian States when the company undertook to lay the Cape-Australian cable provided for a graduated reduction of tariff down to 2s. 6d. a word, if a certain standard revenue were maintained. Unfortunately, it was not maintained during the past year, and therefore it was impossible to reduce the tariff from 3s. to 2s. 6d., as the directors had hoped, on January 1 last. Irresponsible critics were very fond of saying that, if the rates were only reduced, the traffic would so largely increase that the revenue would not be diminished; but experience showed that these views were not borne out by the facts, and that tariff reductions took a very long time to recoup themselves. The following figures would illustrate the point: On January 1, 1901, the company reduced the Australian tariff from 4s. to 3s. 6d. a word, and the number of words transmitted during 1901 was only 1,912,000, as compared with 1,866,000 in 1900; and on January 1, 1902, they further reduced the tariff to 3s., and carried 1,963,000 words during 1902. These figures showed that the work was practically stationary, notwithstanding a reduction of 25 per cent. in the tariff.

Since he last addressed the shareholders many sensational statements had appeared in the press in regard to wireless developments. Nothing had, however, happened, and nothing had come to his knowledge to alter the opinion he had from time to time expressed—that wireless communication was much more likely to be a valuable adjunct to submarine cable companies than to become a competitor with them. This view was evidently held in Germany, France, Holland, the United States and elsewhere, to judge by the extensive projects emanating from those countries for new cables in all parts of the world, some being now actually manufactured for connecting their possessions in the Far East. As he said at a former meeting, it would be rash for any one to put a limit on what might happen in the future, but, judging from what they knew in the present, he saw no likelihood of wireless telegraphy competing with cables for long-distance business, and he thought that that opinion was held very widely. He did not want to be regarded in any way as a hostile critic of wireless telegraphy. He still held that within its limits it would be not only useful to the public, to the navies of the world, and to the shipping community, but that it would also be useful to the company, who, in fact, had already found it to be so within distances of thirty or forty miles.

Edison at the St. Louis Exposition.

President Francis, of the St. Louis Exposition, has received the following autograph letter from Thomas A. Edison, who has accepted the appointment of honorary chief consulting electrician of the Exposition:

ORANGE, N. J., May 18, 1903.

DAVID R. FRANCIS, President St. Louis Exposition:

DEAR SIR:—I beg to acknowledge receipt of your favor of April 22, informing me of the great honor done me in appointing me honorary chief consulting electrician of the Universal Exposition, commemorating the acquisition of the Louisiana Territory.

In thanking you for this honor, and accepting it, I cannot but note with pleasure your reference to the fact that the Exposition year falls on the twenty-fifth anniversary of my perfection and introduction of the incandescent lamp. This recognition of work in the field of electrical invention is very gratifying to me, especially as it comes in association with your magnificent demonstration to the world of what has been done in all branches of industry in the States comprised within the original territory—a region where, as a young telegrapher, I spent many arduous years before moving East.

Permit me to commend your judgment in allotting at the Exposition a fine large building exclusively for electricity, and to express the fervent hope that it will be filled to overflowing with the latest examples of apparatus for light, heat and power and the communication of intelligence.

It will not only be my duty to take part in exhibiting such of my newer inventions as your colleagues may deem worthy of acceptance, but I hope to see from abroad, in rivalry with American advances, the results due to European leaders in the art to which I have given my life, because of my belief in it as one of the noblest agencies ever rendered available for human welfare and benefit.

With the best wishes for the brilliant success of the Exposition and pledging my own assistance as it may be required, I have the honor to remain, Mr. President, very truly yours,

THOMAS A. EDISON.

Transatlantic Wireless Work.

A dispatch from Halifax says: "The Marconi station at Table Head, C. B., is in perfect order for the transmission of messages. The delay in establishing a wireless service between England and America has been entirely due to the station at Poldhu, which is being re-equipped with machinery similar to that at Table Head, and within a few days messages will probably again flash across the Atlantic and the first long-distance wireless service on a commercial basis be established.

"This statement was made by W. D. Deeks, of New York, who is interested in both the Canadian and the American Marconi Companies, and who is on his way from Table Head. Continuing, Mr. Deeks said: 'The present difficulty with us is of a purely mechanical character. But R. N. Vivian, who is in charge of the Table Head station, expects to receive word any day that Poldhu is ready to receive and transmit messages.

"'On Saturday a wireless station was opened in Chicago, and another in Milwaukee, and communication has been established between the two places. In Canada an overland station will be established at Vancouver and others at Port Arthur, the western terminus of the Canadian Northern, and probably at Halifax.'"

Hydro-Electric Development of the French Broad River, N. C.

BY CHARLES E. WADDELL.

THE rapid strides made in the last decade in alternating-current work, and the steady increase of voltage and capacity of units render the description of a 2,250-kw, 6,600-volt plant a matter belonging to the commonplace, and meriting publicity merely because it indicates the steadily increasing confidence on the part of capitalists in electrical investments.

Near Asheville, North Carolina, the Weaver Power Company are now at work developing a hydroelectric plant on the French Broad River. The French Broad rises in the Pisgah forests of the Biltmore estate, and pursues a northwesterly course through the State into Tennessee. The fall from the source to Asheville is slight, but becomes marked some five miles north of the city. The first of the rapids possesses a fall of 13 ft. in a lineal distance of 2,500, and it is here that the Weaver Company have located their plant.

The scheme of development is: 1. The building of a dam across the river. 2. The construction of a canal 3,000 ft. in length. 3. The erection of a power house and equipment.

At the head of the rapids there projects across the river a ledge of granite, running at an angle of 15° with the river, and lying with the fissures and seams facing up-stream. This was selected as the site for the dam as affording an admirable foundation and anchorage. The dam, which is being built of blue granite, is 11 ft. high, 12 ft. wide at the base, 5 ft. wide at the top, and 532 ft. long, and is laid in cement. The purpose of the dam is merely to raise the head, no storage of water being contemplated. According to statistics prepared by the United States Geological Survey, the lowest flow on record is 96,000 cubic ft. per minute, and this amount is more than sufficient to operate the plant.

There will be no super-elevation of head to provide against rise in the river from freshets, for as 6 ft. is the greatest height attained by the water in any past flood, and as the head is 24 ft., it is estimated that the wheels will be capable of giving their rated output at normal speed with this amount of back water.

The canal is 3,000 ft. long, 60 ft. wide at the bottom, 100 ft. wide at the top, and is excavated down to solid rock. The mountain forms the east bank, and a wall had to be built on the river side. From the intake gates at the dam to a point some 2,000 ft. below this wall consists of an earth embankment 38 ft. wide at the base, 12 ft. wide at the top, and lined on the inside with a stone wall 2 ft. thick, laid in cement.

Along the river side willows, aspens and kindred trees are planted, the object being to prevent wash or damage from driftwood in times of floods. The last thousand feet of the wall averages 20 ft. in height, 14 ft. thick at the base, 4 ft. at the top, is built of masonry, and affords together with the dam a total rollway of 1,500 ft.

The power house is located at the end of the canal, the bulkheads of the canal being the power house wall. It measures 50 x 90 ft., and rests on stone arches that span the tailrace. The building will

FIG. 2.—VIEW NEAR POWER HOUSE.

be of brick with a slate roof supported on wood trusses. There will be a 15-ton traveling crane operated by hand.

The water power plant will be located in an open flume, and each unit will be composed of one 54-in. and two 51-in. Hercules turbines direct-connected to a 750-kw generator. There are to be three of these units, which taken with the excitation plant, constitutes the full equipment. Two 21-in. Hercules wheels each connected to a 56.25-kw dynamo, form the exciter plant. The dynamos are direct-current, 125-volt, compound-wound, and operate at 270 r.p.m. The exciters are not provided with governors. Each machine has capacity sufficient to excite all three generators. The water wheel shafts extend through cast-iron heads, set in the power house wall, and couple to their respective generators by means of flange couplings.

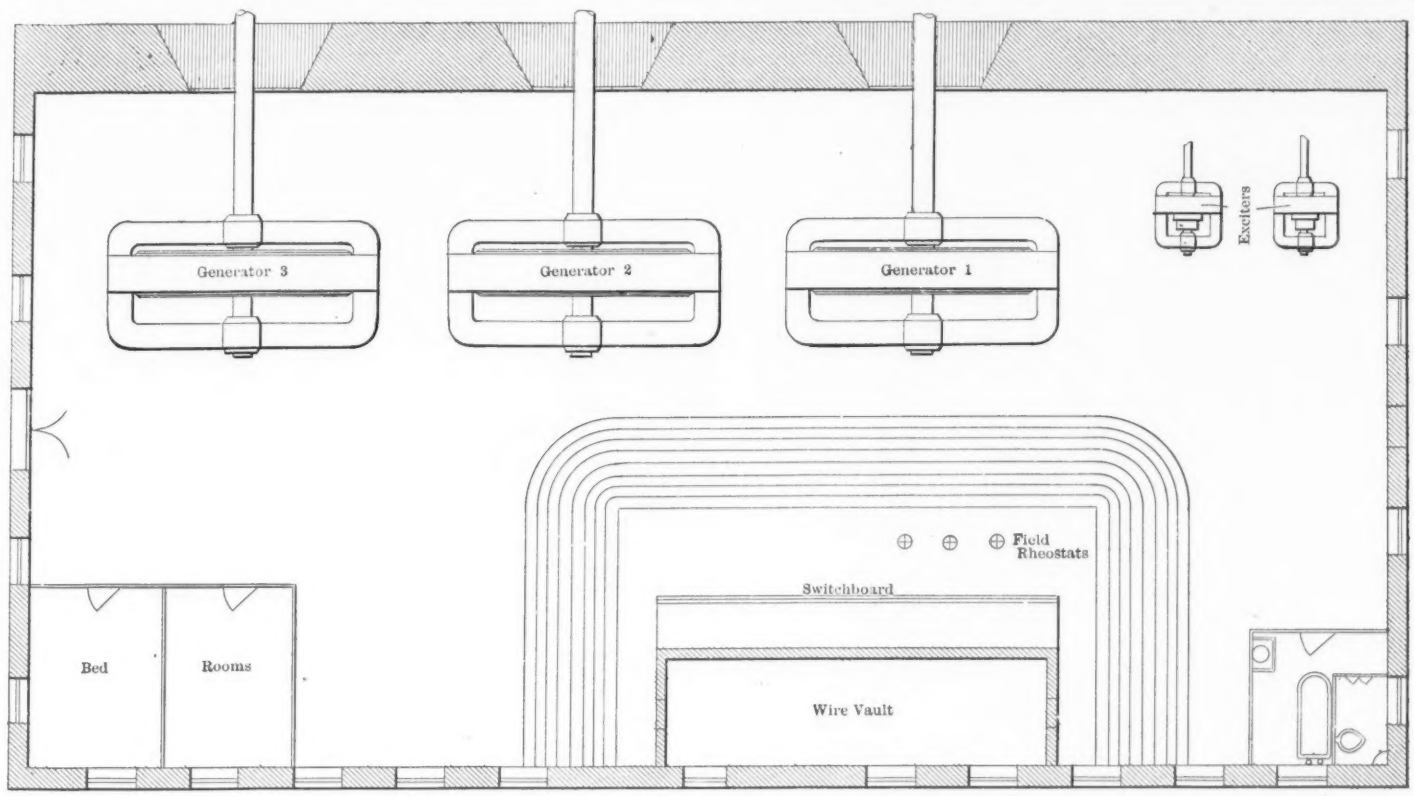


FIG. 1.—PLAN OF POWER HOUSE, WEAVER POWER PLANT.

Each unit is provided with a governor, and the governor is so arranged that the unit may be started or stopped by means of a push button located on the generator panel of the switchboard. This device will be especially convenient for synchronizing.

The generators are of Westinghouse make, are 6,600-volt, 60-cycle, revolving field type, and are designed to operate at a speed of 120

r.p.m. The switchboard is located on a balcony 4 ft. 8 in. above the power house floor, and will be easily accessible, as steps are provided on three sides.

The board stands in front of a wire vault (a section of which is shown in the figure), which measures 8 ft. wide x 13 ft. high, and extends 30 odd ft., the entire length of the switchboard. In it are located the high-tension bus-bars, transformers, lightning arresters, choke coils, oil switches, etc., and as all generator cables and transmission lines terminate herein, no circuit to the switchboard operates at a potential exceeding 125 volts. Motion to the oil switches is imparted by the levers running under the floor. The arrangement of the connections of the machines and board as shown in the figure was designed to secure extreme flexibility. There are two sets of high-tension bus-bars, and two oil switches on each generator and feeder. All or any generator may be operated on either set of busses, and all or any feeder may be connected to either set.

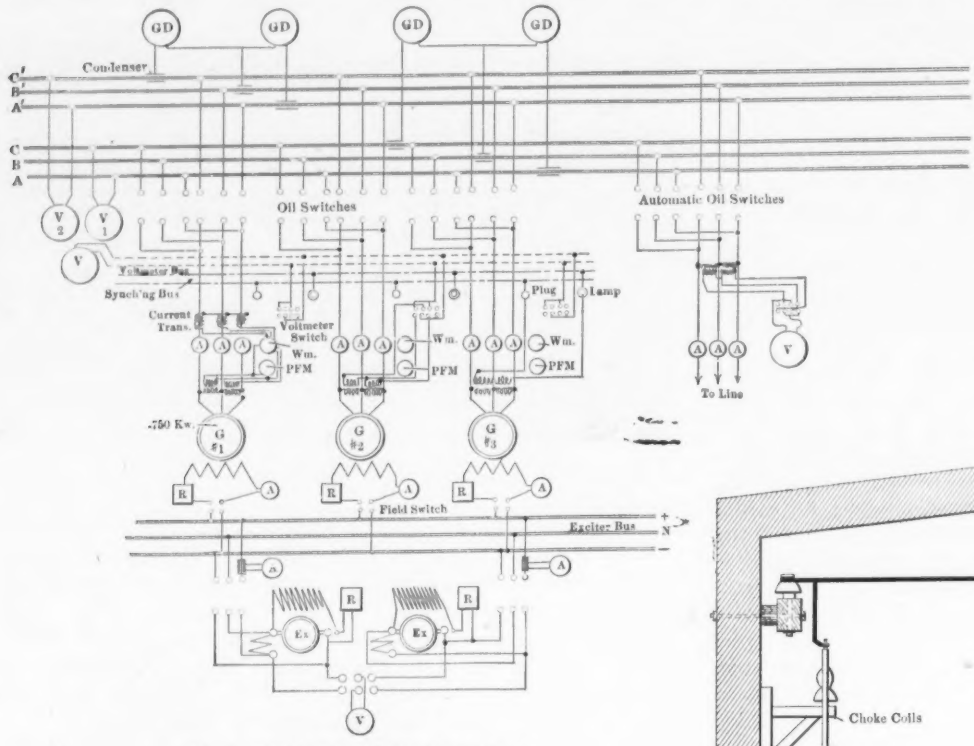


FIG. 3.—DIAGRAM OF CONNECTIONS.

As an example of the flexibility of the system, an inductive load could be switched on one set of bus-bars and one or two generators thrown in to operate it; the remaining generators or generator operating a non-inductive load on the other set of busses. The switches interlock in order to prevent the two sets of bus-bars from being thrown in parallel.

The switchboard consists of four types of panels. Each is made of blue Vermont marble, and equipped with Westinghouse instruments. The types are: (1) Exiter panel, (2) generator panel, (3) power feeder panel and (4) light feeder panel.

The exciter panel contains a voltmeter, two ammeters, switches and instruments of the kind that are usually found on a board of its class. It provides for the operation of the exciters individually or in parallel. The generator panels each contain two oil switches, three ammeters, a power factor indicator, a polyphase wattmeter, and a field ammeter. The field rheostats and switches are mounted on pedestals in front of the generator panels. The power panels contain a voltmeter, an ammeter and two automatic oil switches. These switches operate by means of a relay, and open under an overload on any phase.

The light feeder panels differ from the power feeder panels in that there are three ammeters instead of one. This will indicate the state of the balance on the circuits. In addition to the foregoing instruments there are two electrostatic ground detectors for each set of bus-bars, and three voltmeters, two connected to the sets of bus-bars, and the other to the plug switches on the generator panels, to be used in paralleling.

It is hoped that work will have progressed sufficiently to be able to furnish current to the mills and other industries in and around Asheville by the first of September of this year.

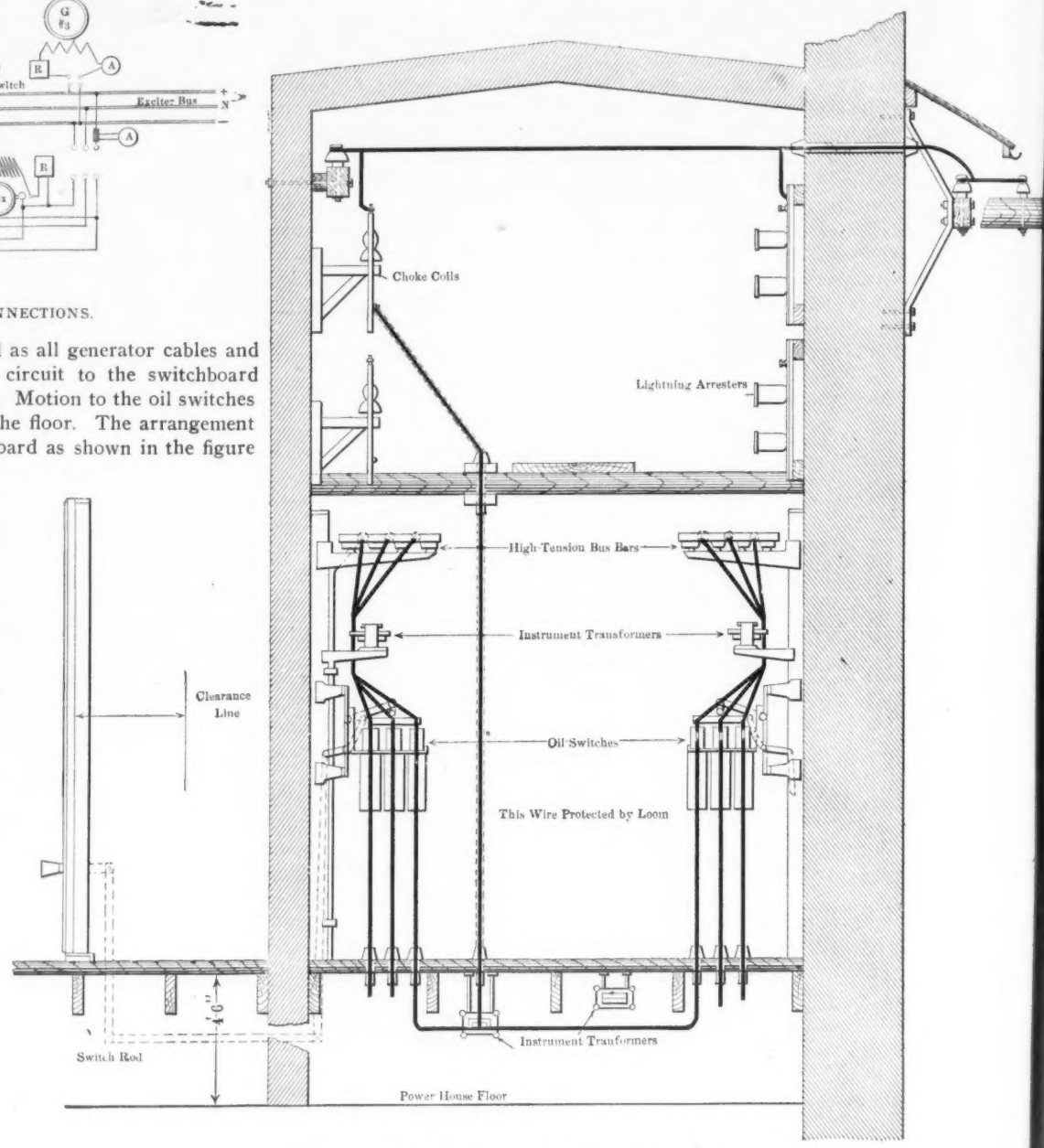


FIG. 4.—SECTION OF VAULT WITH WIRING DETAILS.

Ohio Engineers.

The Ohio Society of Mechanical, Electrical and Steam Engineers held its first annual meeting in Cleveland, May 23. Officers of the association are E. E. Miller, Canton, president; R. G. Ingleson, Cleveland, vice-president; John McConnaughy, Warren, second vice-president; R. H. Probert, Akron, treasurer, and C. J. Miller, Canton, secretary.

Ashtabula Telephone Exchange.

THE Ashtabula, Ohio, telephone exchange has recently been re-equipped with modern apparatus, which places it among the finest exchanges in the State. The Ashtabula Telephone Company was organized in 1896, and the growth has been so rapid that the exchange is to-day several times larger than was first considered possible. After having outgrown several switchboards, as well as the outside construction, a complete new equipment has just been installed for the central office.

The switchboard, which is shown in Fig. 1, is of the lamp signal, common battery, multiple type, and has a capacity for 1,800 lines, with at present 1,000 local common battery lines connected. A separate position on the board is equipped for magneto-rural lines, which class of service the Ashtabula Telephone Company has been recently been taking on. As will be noticed in the photograph, the first, or annex position, is reserved for the necessary multiple jacks; the second, or magneto position, generally known as "B" position, is equipped with 50 magneto drops, for taking care of the rural lines. The operation at this position has within her reach the multiple of every line on the entire switchboard. This position is equipped with

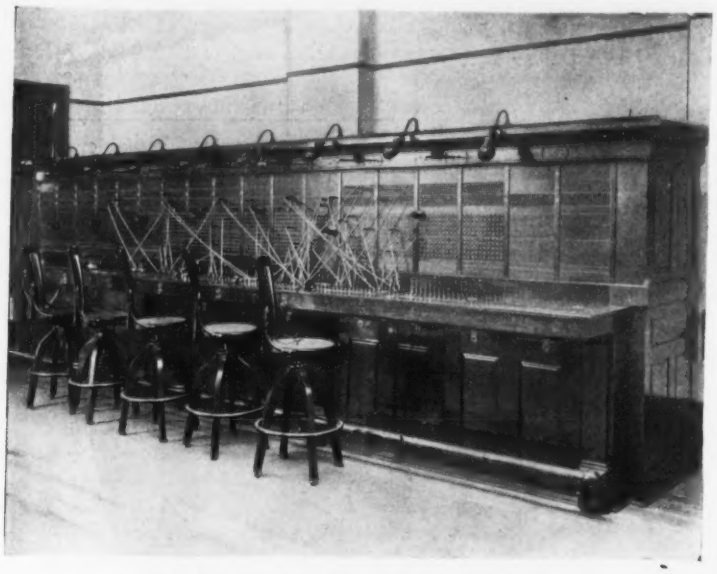


FIG. 1.—GENERAL VIEW OF SWITCHBOARD.

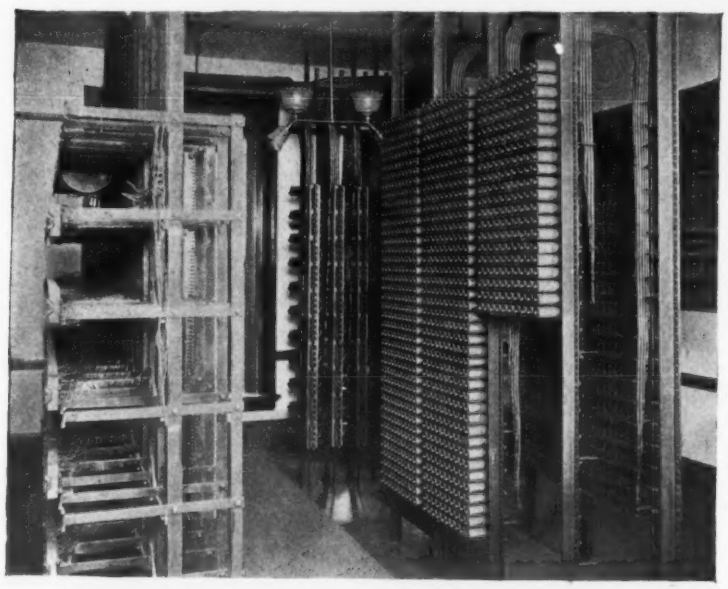


FIG. 2.—TERMINAL ROOM.

party-line signalling apparatus, so that the operator can selectively signal any of the subscribers on her section.

The third position on the board, known as the "switching" or second "B" position, is equipped with a duplicate of all toll drops, as well as with the necessary trunks for handling the toll traffic during the day time. At night the toll service is switched from the separate toll board to the switching position on the main board, so that the night force can handle the entire traffic of the exchange at one point. The switching position is also equipped with busy back signals, so that any subscriber's line temporarily in use can be easily reserved and held for any long-distance work that may be required.

The next five positions, known as "A" positions, and equipped with local lines, are arranged with 200 line equipments to the operator. This has been considered an unusual number of lines for one operator to handle, but the experience at Ashtabula has demonstrated that 200 lines can safely be handled by expert operators and give first-class service. While the service per line on this exchange is above the average for its size, a three-second service is maintained.

Each of the "A" positions is equipped with the necessary cord equipment, including party line keys and with supervisory signals for each cord pair, so that the operator can at all times tell automatically whether a subscriber has answered a call, whether either one has finished, and whether either one is demanding a subsequent call. In addition to this she can selectively signal any party line subscriber with whom she has occasion to connect. This makes this board particularly attractive for work in exchanges of the character mentioned.

The switchboard is finished in golden oak and mounted upon a substantial iron rack, all work being put into it in such a way that additions can be made without any changes in the wiring.

The chief operator's desk, which is not shown here, is equipped with all the necessary listening taps and apparatus for the chief operator in handling the force working under her. In addition to this her desk is equipped with observation lines, so that any lines needing special attention can be covered.

FIG. 3.—GENERATOR PLANT.

Fig. 2 shows what to many telephone men is the most interesting part of the exchange—the terminal room. Here are located the main and intermediate distributing boards as well as the relay racks. To the line side of the main distributing rack are brought all of the outside cables, while on the switchboard side are located the protectors. The intermediate distributing board is also of the open iron rack construction and of the latest design. The relay racks on the right of the cut are strong and substantial, and the relays are so mounted that all parts are accessible. It will be noted that all relays are enclosed in individual dust-proof cases. In this room is also located the wire chief's desk, equipped with meters, switches, plugs, keys and all other paraphernalia necessary to enable him to test any of the lines in use in the exchange.

A most important part of common battery, central office equipment is the power plant. The power switchboard consists of three panels of Tennessee marble, mounted in a substantial iron rack, the panels being equipped with all fuses, switches, circuit-breakers and meters, nothing but the Weston meters being used. The work

in the rear of the power board is substantial and heavy and could take care of the currents required if the exchange were several times its present size

The entire power plant is in duplicate. The generators (Fig. 3) are mounted upon a pedestal which is filled with sand, thus doing away with the noise and vibration often incident to telephone power plants. The charging machines are of the Holtzer-Cabot make, and are designed to work from the various power plants available at this center. These machines are in duplicate, so that in the event of a break-down of one power circuit, the other is available. The ringing machines were manufactured by the same company, one being equipped to work off of the power circuit and the other off of the batteries. It will be noticed that each individual machine bears its number, which corresponds to the switches, etc.

Fig. 4 shows the storage batteries, which are in duplicate, mounted upon angle iron racks of substantial construction. They are the chloride type, and each set is of ample capacity to handle the exchange for 24 hours when running to its full capacity. The wiring to the cells is such that an individual test at the power board can be made of each cell, or each set of batteries can be tested simul-

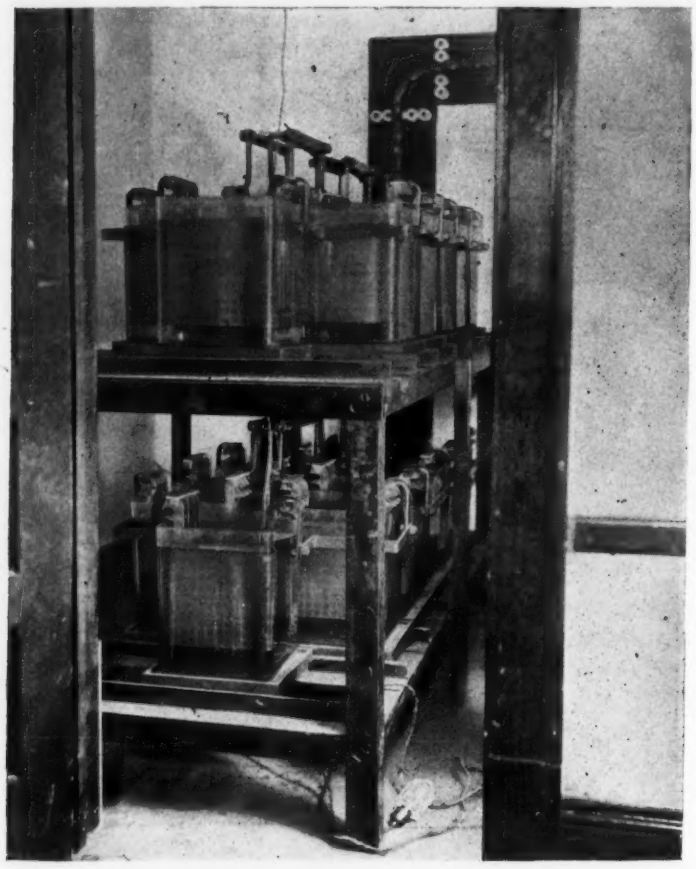


FIG. 4.—STORAGE BATTERIES.

taneously. The power wiring is put in in such a way that there can be no charging induction. The storage batteries are set in a separate room.

The toll board, which is situated in a separate room, is connected by a complete automatic trunking system in such a way that the signals between the toll board and the main board are automatic; the toll operator having complete supervision over all toll calls.

The Ashtabula company has a branch exchange located at Ashtabula Harbor, the board being for 300 lines, on which are handled a great many party lines. This board is connected to the main exchange by several coming and outgoing trunks having automatic signals, all trunks terminating on the second "B" or "switching" position. This gives a complete supervision of all trunk connections by the switching operator.

The Ashtabula Telephone Company erected its own building, investigation proving this to be the most advisable course. The exchange is provided with workship, inspector's room, stock room, operator's retiring room, and everything necessary for the handling of the business. There are, in addition to this, the general office, director's room, as well as the counting office. The North Electric Company, of Cleveland, Ohio, supplied the central office equipment.

Some Educational Points.

BY H. S. KNOWLTON.

THE rise of the technical graduate in the business world and the remarkable increase in his responsibilities which has manifested itself in the last decade are among the most interesting developments of the period. Considering the results of the training offered by the engineering schools, one is led to believe that much additional progress may be made in bringing the college world and active professional life into closer relationship than now obtains.

There can be no doubt that both professional school and business life occupy spheres of activity which are peculiarly their own, and nothing is farther from the intentions of the writer than to decry that thorough groundwork of essential theory which should constitute the basis of every engineer's training. It is certain, however, that the usual four years' course of the technical school or college can in many instances be made of more lasting practical value, even at the cost of eliminating certain antiquated methods of instruction.

One of the most common obstacles to the attainment of a maximum educational efficiency is the exclusive absorption of the instructing staff in their own individually chosen special fields of labor. The importance of emphasizing the relations of the component parts of the curriculum is too often lost to sight, in the anxiety of the instructor lest he fail to secure a maximum amount of work from the student in some particular study, which is the former's hobby. Thus, in the mathematical courses, we believe that the principles of that beautiful science can be quite as well illustrated by examples drawn from engineering practice as by fossilized problems in regard to the distance an intelligent horse will walk in unwinding a taut rope from a hitching post, or the ultimate destination of a theoretical fox pursued by a pack of hounds in full cry over a parabolic path. In the electrical course, for instance, there is ample room for the exercise of mathematical ability in the prospective development of the equation of the railway motor curve, and the problems of the determination of the area of engine indicator cards are quite as likely to appeal to the interest of the proper minded embryonic mechanical engineer as the probability of drawing two red balls out of a possible five from a green bag in a theoretical raffle.

As far as possible, illustrations of principles studied in the various subjects taken up should be drawn from modern engineering and business as actually carried on in daily life. In mechanics, the railroad of to-day furnishes an almost inexhaustible supply of interesting and live problems. The tractive power of locomotives, train resistance, strength of bridges, carrying capacities of cars, relations between speeds, roadbed and track, consumption of fuel and intricacies of interlocking plants are but suggestions of the fascinating mechanical questions which compel the enthusiasm of the interested student. Similarly the electrical engineer student who has not mistaken his calling can be roused to a high pitch of working energy by giving him problems based upon the practice of neighboring electric railways, power transmsision, lighting, telephone and telegraph interests.

The importance of frequent visits to industrial plants in the vicinity of the professional school cannot readily be overstated. As practice in training observation and bringing the students in touch with applied theory it ranks high in method. Even if the cost of such visits be the lessening of laboratory and machine shop practice by a few hours each fortnight, it is well worth while to make the trips, and the special processes and appliances noted should frequently form the subjects of future discussions in the classes instead of, as is often the case, being allowed to pass before the student's eye like a rapid panorama.

Lectures by prominent business and professional men afford excellent opportunity for students to come in contact with the essence of expert practical experience and advice. It is difficult to compress into a single sentence the broadening personal influence which the presence of a distinguished practicing specialist upon a professional school lecture platform imparts, but it is safe to say that no feature of the student's technical training is more powerful in promoting liberal mindedness. Hours spent with leaders in the professions are high privileges, and remain fixed in influence as the years go by. To neglect opportunities in this direction is to make a serious mistake, and to run in danger of intellectual narrowness of the most provincial degree.

Economics for engineering students can be made a thoroughly interesting and profitable study if the industrial life of the present day be turned to account. Questions of organization, finance, statistics, labor and management can be analyzed at practically first hand in these days of accessible information. Many a technical graduate does not know the difference between a contract and a requisition when he receives his degree, and cannot distinguish between a share of preferred stock and a bond. With enormous aggregations of capital like the United States steel Corporation and the Atlantic ship combine to study, and with financial documents like the Pennsylvania Railroad's Annual Report to analyze, it is difficult to realize how the applications of economics in modern business can fail to add interest and progressive ideas to the briefest course in industrial science. The present stormy scenes between labor and capital, the controlling of markets, fluctuations in prices of securities, governmental suits against 'holding corporations," and the widespread applications of insurance, open up an inexpressibly broad field of reading, which bears directly upon the occupation of the would-be engineer.

Finally, one cannot but urge the ever-increasing advantage of making the utmost possible use of the professional journals. Discussions in class of their contents has been found most helpful by those who have tried it, and the satisfaction of keeping in touch with installations and methods of latest value, is great. Through the medium of the technical press many interesting and important tests, discoveries, and laboratory experiences can be made available for the world's use, with advantages to every participant in the bringing to light of new combinations of mind and matter, and in the same manner the academic atmosphere of the technical school can be freshened and invigorated by the contact with the commercial world which the technical journal brings about through its editorials, descriptions of progressive installations and general news. The experiences of both business, world and educational life can thus be interchanged, to their mutual advantage.

Canadian Power Development at Niagara Falls.

BY ARTHUR B. WEEKS.

The work of power development on the Canadian side of the Niagara River is being rapidly advanced. The Ontario Power Company has drills at work at the edge of the cliff in front of the forebay. A ledge of rock overhanging the site of the power house is to be removed, and work on the course of the penstocks will also be carried on from this point.

Several small tunnels to be used for heavy blasts are being bored into the foot of the cliff near the site of the power house. Work has also been begun on this site, nothing having been done during the winter because of the accumulations of ice.

The removal of the reef of rock lying across the head of the Ontario Company's canal has been begun by the Niagara Construction Company, which has also erected a large number of buildings to be used as storehouses, etc. The intakes of the Ontario and Toronto Companies are side by side. Work is being carried on here with difficulty, because of the encroaching of the rapids on the cofferdams; yet considerable rock is being removed.

The old suspension bridge, erected in 1879, across the mouth of the channel at Dufferin Islands is being torn down, to make room for the works.

At the wheelpit of the Canadian Niagara Company, preparations for alteration are everywhere apparent. The present pit has already been sunk to nearly the required depth, and part of the machinery used in excavating is being removed. The extension of the wheelpit will soon be begun. The site is being cleared of mountains of stone for the power house, and several buildings and railway tracks will be moved. The extension is to be in a line directly south of the present excavation. Stone for the forebay is now arriving and being lowered into the excavation.

Gangs of men have been increasing steadily in numbers, and many hundreds more will soon be engaged. The debris of countless decades is being cleared away from in front of the portal of the Canadian Niagara Company's tunnel, which is now being completed. Though the water is being held back by an enormous cofferdam, so much runs in from spray and springs that three large pumps are kept in constant operation, and can scarcely hold the water under control. The shaft of the new scenic tunnel at Table Rock, which is to replace the one demolished by the work of power development, has been already sunk to a depth of nearly 40 ft.

Altogether, the Canadian bank of the Niagara above the Horseshoe fall presents a most unusual scene of bustle and activity, almost rivaling the rush and ceaseless industry of the rapids themselves.

Edison in Wireless Telegraph.

It is announced that Mr. T. A. Edison has been appointed to the board of technical engineers of the Marconi Wireless Telegraph Company of America, and has permanently identified himself with the company by the acquirement of an interest therein as a stockholder. It is officially announced at the office of the Marconi Company that the company has acquired Mr. Edison's patents. The principal Edison patent, in its claims, covers the field of wireless telegraphy by inductive means. While modern wireless telegraphy is based upon Hertzian wave transmission and not on induction, the Edison patents are stated to be considered important additions to the patents owned by the Marconi Company, which include also the inventions of Prof. M. I. Pupin, who, it is stated, is also a member of the company's technical corps.

Edison's first patent on wireless telegraphy, secured by the Marconi Company, is dated December 29, 1891, and in it he declares:

"I have discovered a new and useful improvement in means of transmitting signals electrically, having elevated induction plates or devices. I have discovered that if sufficient elevation be obtained to overcome the curvature of the earth's surface and to reduce to a minimum the earth's absorption, electric telegraphing or signaling between distant points can be carried on by induction without the use of wires connecting such distant points. This discovery is especially applicable to telegraphing across bodies of water, thus avoiding the use of submarine cables, or for communicating between vessels at sea, or between vessels at sea and points on land; but it is also applicable to electric communication between distant points on land, it being necessary, however, on land, to increase the elevation in order to reduce to a minimum the induction-absorbing effect of houses, trees and elevations in the land itself. At sea, from an elevation of 100 ft., I can communicate electrically a great distance, and since this elevation, or one sufficiently high, can be had by utilizing the masts of ships, signals can be sent and received between ships separated a considerable distance, and by repeating the signals from ship to ship, communication can be established between points at any distance apart or across the largest seas, or even oceans. The collision of ships in fogs can be prevented by this character of signaling by the use of which, also, the safety of a ship in approaching a dangerous coast in foggy weather can be assured, In communicating between points on land, poles of great height can be used, or captive balloons. At these elevated points, whether upon the masts of ships, upon poles or balloons, condensing surfaces of metal or other conductor of electricity are located. Each condensing surface is connected with the earth by an electrical conducting wire. On land this earth connection would be one of the usual character in telegraphy. At sea, the wire would run to one or more metal plates on the bottom of the vessel where the earth connection would be made with the water."

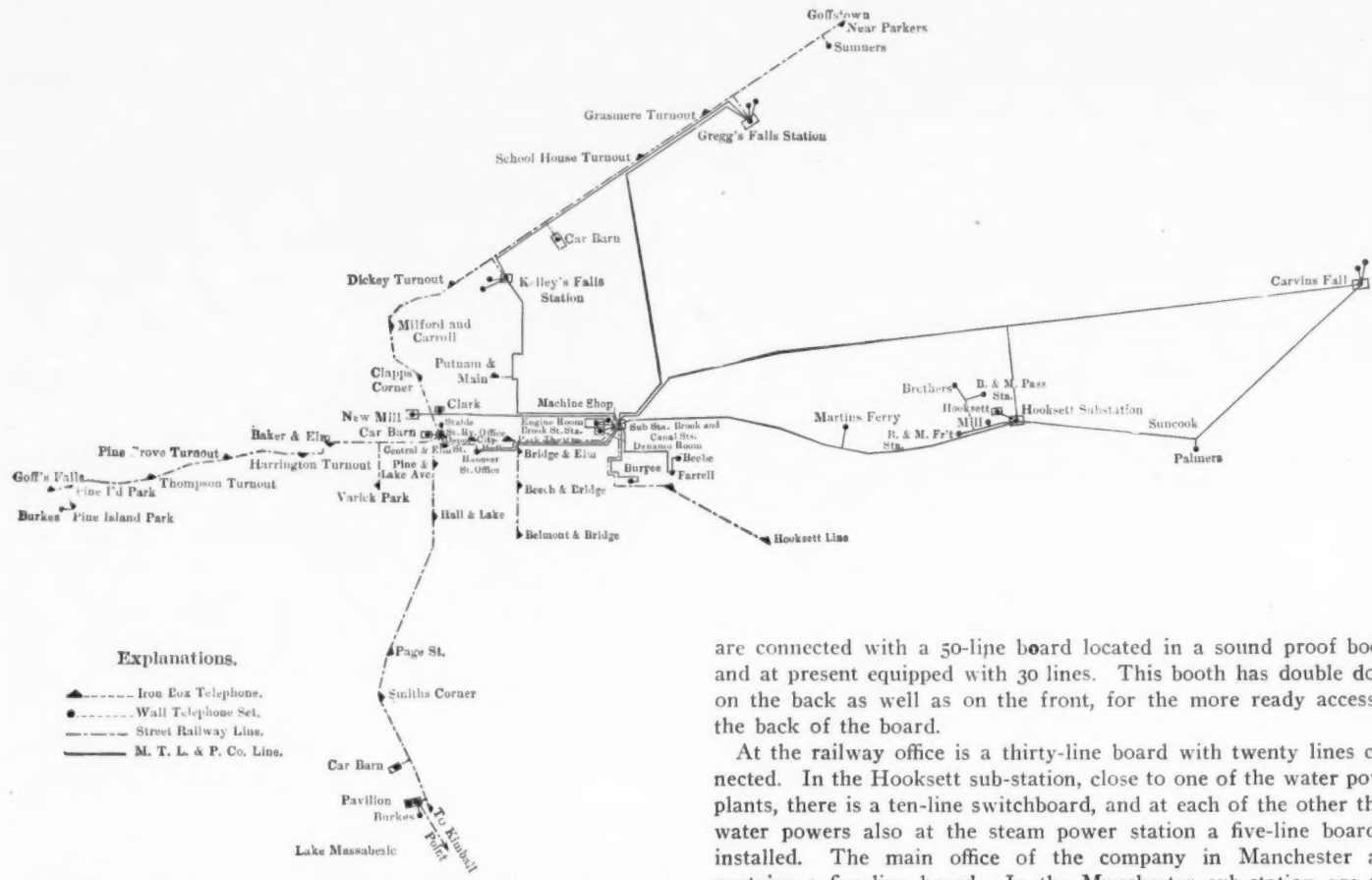
Fire Protection Engineering.

Armour Institute of Technology, Chicago, has instituted a four years' course in fire protection engineering, leading to the degree of bachelor of science. The course will be inaugurated September 21, 1903, under the direction of Prof. Fitzhugh Taylor, formerly an engineer of the Underwriters' Laboratories. The requirements for admission are identical with those for the mechanical, electrical, civil and chemical engineering courses. Advanced students will be given due credit for work done in other engineering courses of the College of Engineering of Armour Institute of Technology or of other colleges. A special feature of the course will be a series of lectures by prominent insurance officials, architects and contractors, upon the practical features of their work. The technical laboratory work of the ceurse will be given at the Underwriters Laboratories, Chicago, under the direction of experts connected with the laboratories.

Telephones in a Lighting and Traction System.

MANCHESTER, New Hampshire, is the center of a lighting and traction system that includes five generating stations, two sub-stations, 33 miles of high-voltage transmission lines and 36 miles of electric railway track. These equipments are scattered over a territory covering a radius of about 14 miles, using the city as a center, and are all controlled from the main office there.

Centralized management of these widely-separated properties depends in no small degree for its complete success on the extensive use of telephones. To render the telephone system most effective it must be devoted exclusively to business of the electric lighting and railway interests, and it has, therefore, been constructed entirely by the Manchester Traction, Light & Power Company, the owner of these plants. As the telephone system stands, immediate communication may be had between the main office of the company and either of the generating stations, sub-stations, car barns, or pole telephones along the railway tracks.



MAP OF TELEPHONE SYSTEM OF MANCHESTER TRACTION, LIGHT & POWER COMPANY.

Centralized control in the operation of this system is especially necessary because the four water power stations and one steam power station, all widely separated, must work in multiple on loads made up of arc and incandescent lighting, stationary motors and electric cars. No one station being able to carry the entire load, the number of generators operating at any time in any one station must be regulated according to the number in use at the other stations. As far as possible, it is desirable that each particular generator and its transmission line be devoted exclusively to either electric railway or general electrical supply, and this furnishes additional reason for prompt communication throughout the entire system.

The general plan of operation is to have all of the five generating plants feed into the sub-stations at Manchester, and from this sub-station energy is sent out for the several classes of service. At intervals along the suburban railway lines there must be telephones, so that persons in charge of cars can communicate with the railway office. Finally, the residences of employees are connected with the telephone system.

Equipment of the telephone system includes 75 miles of circuits, one fifty-circuit, one thirty-circuit, one ten-circuit and five five-circuit switchboards. The 75 miles of telephone circuit are all double, thus using 150 miles of wire, and the circuits are attached to pole lines that also support the transmission or distribution lines or railway feeders, as the case requires. All of the telephone lines are of No. 12 galvanized iron wire, brand "Extra B B," of Washburn & Moen make. Telephone circuits to Kelley's Falls, Gregg's Falls, Hooksett and Garvin's Falls, the four outlying water power plants, follow the pole lines that carry high-voltage transmission wires. Telephone circuits on these poles are strung some feet below the transmission lines.

All of the telephone circuits that run directly to generating stations center at the Manchester sub-station. All of the telephone circuits that follow electric railway lines center at the railway office in Manchester. Independent telephone circuits connect the railway office and the Manchester sub-station, also these two with the main office of the company there. At this sub-station the telephone lines are connected with a 50-line board located in a sound proof booth, and at present equipped with 30 lines. This booth has double doors on the back as well as on the front, for the more ready access to the back of the board.

At the railway office is a thirty-line board with twenty lines connected. In the Hooksett sub-station, close to one of the water power plants, there is a ten-line switchboard, and at each of the other three water powers also at the steam power station a five-line board is installed. The main office of the company in Manchester also contains a five-line board. In the Manchester sub-station are two magneto generators, each belted to one of two motor-driven blower sets there, which latter maintain a pressure for the air blast transformers.

One of these magnetos is always in operation and furnishes current for bell ringing. At the other stations hand magnetos are employed for a similar purpose. Each telephone set is equipped with 1,000-ohm bridging bells and each transmitter is operated by two cells of dry battery. The five and ten-line switchboards were designed by Mr. J. Brodie Smith, general manager of the company, and are so arranged that one or two pairs of lines may be connected without the use of switchboard cords. The telephones and switchboards were manufactured by the Couch & Seeley Co. All of the switchboards and instruments are provided with D. & W double-pole telephone protectors, which have 2,000-volt, 3-amp. enclosed fuses for the line and 0.3-amp. sneak current-breakers. At the Manchester sub-station and the railway office these protectors are mounted in weather-proof boxes outside of the buildings, and the lines are led in through cables. Two cables are there used and each of them contains wires enough to connect with all of the lines that come into the sub-station. In this way, should one cable be disabled the other may be at once connected up. As may be seen from the map, it is possible to reach each generating station from either the Manchester sub-station or the main business office of the company by two independent telephone lines.

American Institute of Electrical Engineers.

At the annual meeting of the American Institute of Electrical Engineers, a general account of which appeared in our issue of May 23, three papers were read, all dealing with alternating-current subjects. Prof. Comfort A. Adams, of Harvard University, presented a lengthy paper giving the theory of the Heyland machine as a motor and generator, and including descriptions of tests made on such a machine at Harvard. The paper opens with a brief resumé of the principles of the predecessors of the Heyland type of motor, including those of Gorges, Le Blanc and Blondel. After a description of the Heyland motor, the paper develops the subject under the heads of reactance of exciting winding; description of machine tested and theory of operation; general conditions of tests; results of tests; the Heyland machine as a generator, and compound excitation. Numerous curves are given obtained from tests of the machine experimented with. Owing to the character and length of the paper—which occupies 49 pages of the Transactions—it is impracticable to give a satisfactory abstract of its contents.

Mr. B. A. Behrend presented a paper entitled, "The Experimental Basis for the Theory of the Regulation of Alternators," which was prepared upon request to aid the Institute Committee on Standardization to draw up rules for a redetermination of voltage regulation, the present rules being by no means in accordance with fact and observation. The paper contains a number of regulation curves of different alternators, and includes some general remarks on the value of the short-circuit characteristic in the design of electric generators. In summing up, Mr. Behrend says it has been demonstrated that the application of the ampere-turn method, as proposed by the Institute rules, leads to entirely wrong results. It gives rise to machines of inferior design and large leakage, that appear in regulation not only equal to, but even better than, machines of careful and superior design. In a word, the method is not scientific and not in accordance with fact and observation. The ampere-turn method, while very simple, is inherently wrong, and it should, therefore, not be used, even if it is impossible to substitute an equally simple rule for it. The desire to have such a simple rule should not tempt us to adopt one that is false.

The third paper, in the absence of the author, Mr. A. S. Garfield, was read in abstract by Mr. Gano S. Dunn, the title being "The Compounding of Self-Excited Alternating-Current Generators for Variation in Light and Power Factor." The paper gives a description of the characteristics of a polyphase revolving-field generator provided with a single closed-circuit field winding and commutator. The effects of shifting the brushes at various inductive and non-inductive loads are represented graphically. The data on which the paper is based was placed at the disposal of Mr. Garfield by Mr. Marius Latour, who has developed this type of machinery.

In the discussion Mr. Behrend called attention to one or two matters which he had not had an opportunity to take up in the paper. One is the great importance of providing for regulation in a specification. Consulting engineers occasionally specify and demand a regulation of 5 per cent. on a 100 per cent. power factor, and a regulation of 12 per cent. on an 80 per cent. power factor, and an increase of excitation of 10 per cent. between voltage at no load and voltage at 80 per cent. power factor. Such a requirement is impossible. One object of his paper was to point out a method by which one can convince him as to what conditions are possible to obtain. Furthermore, the specification of the regulation itself is an important factor in the operation of generators, for with a regulation of 5 per cent., there will be cross-currents between machines which, if not particularly troublesome, will be a disagreeable feature. There is no need for such regulation under ordinary conditions. It is injurious, because you have to pay for it, and because you have to regulate anyhow, and it does not make any difference whether you regulate within 5 per cent. or 7 per cent. It increases coal consumption and makes operation poorer. Prof. Adams corroborated what Mr. Behrend said in regard to the ordinary methods for the calculation of alternator regulation. He has made tests on a few large machines, and the results are entirely corroborative of Mr. Behrend's results, that the e.m.f. method gives, almost invariably, results which are too poor, and that the e.m.f. method gives too good a regulation; that in machines of inductive type, with armature leakage, reactance plays a larger part than the armature reaction. The e.m.f. method fits more nearly the machine with least reaction and most reactance, because it is entirely e.m.f. drop, part armature reaction and part armature reactance. In the machine with most armature reaction and least armature reactance—cases of the ordinary low frequency, revolving field alternator of to-day—the other method will fit more closely; but in either case it is very hard really to get accurate results over any wide range.

Mr. William L. Waters said that by far the best method in guaranteeing the regulation of an alternator is to guarantee it for a low power factor. The quantity to be measured is much larger than for a guarantee on unity power factor; and by running a test with two machines as described by Mr. Behrend, one running as a synchronous motor and the other as a generator, and then adjusting the excitations, one can easily get a direct reading for the regulation, even on very large units.

As regards the advisability of having the regulation guaranteed for low power factor, even in the case of running rotary-converters, he gave an incident that came to his notice of a station having several 800-kw, 3-phase alternators, running rotary-converter sub-stations, in which a break-down one day occurred on the high-tension leads of the alternators causing a temporary shut-down of the plant. Then, when the alternators were again run up the rotaries had to be started from the alternating-current side. As soon as the voltage showed up again in the sub-stations, all the sub-stations threw on their rotaries at the same time, and the consequence was an immense lagging current cutting the volts right down and the rotaries refused to start. The attendants seeing this cut out their rotaries and the volts rose again. This went on two or three times and in the end it was about three-quarters of an hour before the sub-stations got started properly. These alternators had a regulation guaranteed of 7½ per cent. on unity power factor. The alternators would satisfy this guarantee if tested by the Institute rules, but their behavior on low power factors can be imagined from the above incident.

Mr. Waters considered that neither of Mr. Behrend's two empirical methods for determining regulation are accurate, and that every designer has to modify these empirical methods in order to obtain satisfactory results on his own individual machines. Some years ago he did some work on the method of obtaining the regulation of the alternator by splitting the effect into armature reaction and self-induction, and in measuring the self-induction of the armatures of some thousands of alternators, with different relative positions of the armature and field, he found this value to vary very considerably according as the relative position of the armature and magnets was changed, and in some machines of very small air-gap the variation was of the order of six or eight to one. These measurements, of course, did not actually represent the condition of things under load, but they give some idea of what variation may be expected. The short-circuit method of determining the compounding on a direct-current machine is very old and was used with fair success on the old smooth-core armature machines, but in modern slotted armature machines, with highly saturated teeth, the distortion of the field on account of armature reaction, makes a large increase in ampere-turns necessary on full load to overcome the decreased permeability of the iron due to this distortion; and so, though this method may give fairly good results in a machine in which the teeth density is not over 125,000, it will be very inaccurate on machines with highly saturated teeth, say machines with teeth worked at 150,000. The compounding ampere-turns necessary in this latter case would probably be double that given by the short-circuit method.

Mr. Behrend, in reply, said that Mr. Waters had pointed out one of the principal weaknesses of his paper. He pointed out that the arbitrary application of a cap diagram to the determination of the regulation at different power factors. That is perfectly true. We are in a sea of arbitrariness. In determining the conditions under which machines have to operate, and in determining the exact dimensions of machines, we continually flounder in a maze of assumptions more or less arbitrary. He pointed that out in his paper, and has pointed it out invariably in his papers on the induction motor, and in papers on other matters connected with electrical engineering. Electrical engineering is an art and not a science. As you cannot teach any one to make a good picture if he has not the natural aptitude, so you cannot teach a man how to design a motor. This must be left to the engineer's ability, and it is a question of judgment in designing. If this falls in the hands of an unskillful man, the result will be like the knife in the hands of a bungling surgeon, and results will never be satisfactory if implements are put in the hands of those who do not know how to use them.

Twenty-Sixth Convention of the National Electric Light Association.

THE twenty-sixth, annual convention of the National Electric Light Association was held at the Auditorium Hotel, Chicago, from May 26-29, inclusive, and in our issue of last week several pages were devoted to the exercises and papers of Tuesday, the first day. The later proceedings are treated in the present issue. Mr. Louis A. Ferguson made an admirable president, and his year of office has been the most successful in the history of the Association; while the convention itself was one of the very best. An attendance of over 900 would be enough to make it remarkable, but the papers and discussions were also far beyond the ordinary and each session was crowded.

At the close of the convention, in executive session an amendment to the Constitution and By-Laws was adopted, making the dues of associate members twenty dollars. This simply corrected an oversight in omitting the dues of associate members from the amendment adopted at the Cincinnati convention.

The report of the Committee on Nominations was presented and the following-named gentlemen were elected as officers for the ensuing year: President, Charles L. Edgar, Boston; first vice-president, S. B. Livermore, Winona, Minn.; second vice-president, J. W. Lieb, Jr., New York.

Members of Executive Committee for three years: Louis A. Ferguson, Chicago; Harry Bottomley, Fall River, Mass.; Alex Dow, Detroit.

President-elect Edgar was escorted to the chair and thanked the Association, and said: "I recognize that it is an honor to be made president of this Association. It was my good fortune to be vice-president in 1890. It is impossible to describe the difference between the meeting of the Association in 1890, at Cape May, and 1903, in Chicago. I recognize I have a hard row to hoe. Each president naturally desires to make his meeting somewhat better than the previous one; and I know you will all admit I will probably not make the meeting next year anywhere equal in interest and importance to that through which we have just passed. I do not know that I can say a word more to emphasize it than that the success of this meeting is due to Mr. Ferguson. We all feel it, and we hope he appreciates the fact, that we know he as president has done more to promote the interests of the National Electric Light Association than any previous president."

On motion of Mr. Scovil, a vote of thanks was passed to the retiring president, Mr. Ferguson, which was gracefully acknowledged.

The report of the treasurer was presented, and showed the following financial transactions during the year:

Receipts, including balance, 1902	$17,091.52
Disbursements	8,439.55
Balance	$8,651.97

In connection with the report of the Committee on Standard Rules for Electrical Installation, the following resolution was passed:

Resolved, That a vote of thanks be tendered the Committee for its diplomatic and effective efforts to secure a reasonable and practical set of rules;

That the Association expresses its appreciation of the importance of co-operation with the National Board of Fire Underwriters in work where mutual interests are involved, and that it recognizes the value of the results obtained since there has been such co-operation;

That a set of the rules and the report of the committee be printed and sent to each active member of this Association, and that action on said committee report be deferred until the next regular meeting of the Association;

That any change in the personnel of the committee for the coming year be referred to the incoming president for such action as he may deem desirable.

On motion of Mr. Scovil the following resolution was passed:

Resolved, That the proper officers of this Association suggest to the National Underwriters' Association that they would consider it a compliment if they can see their way clear to include the cost of their electrical inspection in their rates.

On motion, the action taken at the Cincinnati convention fixing the place for the 1904 convention at St. Louis was reconsidered, and the matter of the time and place for the 1904 convention was left with the Executive Committee. Boston was subsequently selected.

On motion, it was voted to hold a special meeting in St. Louis in September, 1904, in conjunction with allied organizations.

On motion of Mr. J. G. White, of New York, the thanks of the Association were given to the electrical interests of Chicago, particularly the officials of the Chicago Edison Company, for the information, assistance and attention given and rendered to the delegates to the convention, and the secretary was also instructed to send a copy of this resolution to the chairman of the Entertainment Committee, Mr. J. Wolff.

The convention then adjourned.

LOST AND UNACCOUNTED-FOR CURRENT.

Mr. L. G. Van Ness, in a paper with the above title, classifies the losses in current distribution as follows: Alternating current: Transformer iron loss, resistance loss, meter shunt loss, unaccounted-for current loss. Direct current: Resistance loss, meter shunt loss, unaccounted-for current. Means for the determination of these various losses are given.

The following table shows the output and losses for an average winter day for 5 feeders which have received considerable attention in the way of design. One of the peculiarities of the data are that in feeder 4 the meter shunt loss amounts to more than the transformer loss. This is due to the fact that the feeder supplies a residence section by a carefully designed three-wire network. The conditions here were such that the transformer capacity could be so installed that very little more than the demand for the feeder was necessary in order to give proper regulation.

Table 2 shows the loss and unaccounted-for current in the case of a certain station. It will be noted that the transformer loss remains throughout the same. As a result of this analysis, it is stated

TABLE I.

	Trans. Iron Loss.		Resistance Loss.		Meter Shunt Loss.		Output.
	Voltage.	Watt-hrs.	Per cent.	Watt-hrs.	Per cent.	Watt-hrs.	Per cent.	Watt-hrs.
1 ..	1,000	28,488	6.76	23,923	5.68	14,916	3.54	421,000
2 ..	1,000	19,752	3.78	25,086	1.98	19,092	3.65	522,400
3 ..	1,000	28,680	9.56	17,026	5.60	23,316	7.77	300,000
4 ..	2,000	20,712	5.01	29,691	7.28	24,504	5.93	413,000
5 ..	2,000	42,576	8.55	28,867	5.79	18,720	3.76	477,600

TABLE II.

	Trans. Fe. Loss.		Resistance Loss.		Shunt Loss.		Unaccounted for.	
	Kw-hours.	Per cent.	Kw-hours.	Per cent.	Kw-hours.	Per cent.	Kw-hours.	Per cent.
January .	29,296	14.3	7,849	3.76	7,486	3.58	43,205	20.6
Febru'y .	26,163	14.5	6,588	3.66	6,625	3.68	36,096	20.1
March ..	28,153	16.9	4,377	2.62	7,121	4.28	23,958	14.4

that losses will be cut something like 10,000 kw-hours per month in a short time. As a result of the analysis the resistance loss has already been decreased with very little expenditure, and the unaccounted-for current loss reduced about 45 per cent. in three months. It is not expected, however, that the meter shunt loss will be reduced.

SALT AS A BY-PRODUCT.

Mr. Alex Dow, in the paper with this title, advocated using exhaust steam by electric light plants to evaporate salt brine in districts where this cannot be obtained. One plan suggested is that the electric plant be worked condensing during the hours of heavy load and non-condensing during the other hours, the exhaust then going under the pans of the salt plant. He admitted that this arrangement would not be profitable where the load during part of the day was so light that live steam would have to be used under the pans; but if a continuous load can be obtained for the electric light plant, a continuous and profitable operation can be assured for the salt block.

By means of the combination, however, a sufficient inducement may probably be offered to power users that will result in a good load curve during the working hours of the day, and there is even a chance of working up to continuous twenty-four-hour operation.

FIRST AIDS AND APPLIANCES.

A paper by J. D. McGowan, M. D., gives information for use in the case of bodily accidents. The information covers preliminary treatment, treatment for bleeding, burns, wounds, fractures, the use of splints, the transportation of wounded and electric shocks. We give below the information for the treatment of a case of the latter:

Place the patient in a warm, quiet place; after dressing wounds, wrap him in warm material and apply heat to the whole body, using hot water bottles, water bags, hot bricks, blankets, flannels wrung out of hot water (no heat to head), hot drinks (coffee best), spirits of ammonia diluted with water, or small amount of whiskey. Susceptibility to shock depends upon the individual; women and children being less resistant than men. Diseases of heart and kidneys predispose to accident from electric shock. Do not lower the head of a person who has received electric shock. Artificial respiration should be kept up for hours. Massage of abdomen and left side over the heart. Heat to body as above.

It is somewhat remarkable in view of the very complete knowledge available for the treatment of electric shock, that a paper read before an electrical association should contain such a perfunctory treatment on the subject.

In reply to a query, Dr. McGowan said that in case of damage to the eyes from flash, the best thing is to drop in the eyes some sweet oil or castor oil, then a solution of boracic acid and to ease the pain a little cocaine. In reply to a question as to what to do in case a shock produces spasms, he said that the best thing was to put the man in a hot bath, keep him quiet and bathe him. If there is no place in which he may be bathed, some clothes may be placed in hot water and wrung out. Mr. C. M. Lewis, of Bellevue, Ohio, spoke of a case where a man had had his hands badly burned through electrical contact, and after three weeks' treatment by a physician the wound was healed but slightly. One of the men in the station then suggested the use of powdered bismuth, and after dressing his hands only once they improved and were entirely well in two weeks.

HALLBERG PAPER.

In the discussion of the paper by Mr. J. Henry Hallberg on 4-amp. lamps for street lighting, an abstract of which was printed last week, Mr. W. D'A. Ryan said there is no question that the 4-amp. lamp as compared with the 6-amp. lamp has advantages in distribution, the better distribution of the smaller unit more than compensating for the higher efficiency of the large unit. He considered, however, that an advantage can be gained by the use of a ⅜-in. carbon instead of a ½-in. carbon. In reply to a question, Mr. Hallberg said that no lamp in Cincinnati is allowed to remain out more than two hours. If a lamp is defective a new one in that time is put in its place. The Cincinnati system of lamp attendance is such that a lamp has never been out more than two hours. With 4,500 lamps in operation, there are from 25 to 40 trouble calls in a night. Mr. H. C. Wirt said that with small light units the cost of maintaining lamps is greater. One objection to the enclosed system is that the volts per lamp being greater, the street wiring has to be nearly duplicated as compared with a 45-volt lamp service. Mr. Hallberg said that in figuring the lamp efficiency at 70 per cent., he had not considered the general plant and cost and maintenance of cables. In Cincinnati rubber-covered underground cables are used, the voltages varying between 4,500 and 5,200, and there has as yet been no electrical break-down in the system or any appreciable depreciation. He said that the city pays $73 per lamp connected with the underground system, and $8 to $10 less for those connected with the overhead system. He considered that the closed-base inner globe introduces an element of danger, especially with high-tension arcs; for if the arc produces a flame the chances are ten to one that it will jump over to the frame and not only put the lamps out but ruin the lower part of the lamp. In Cincinnati it was decided that the open-base inner globe is preferable. In reply to an inquiry, he said that the Cincinnati system operates at exactly 4 amp. Mr. Hallberg agreed with Mr. Ryan that ⅜-in. carbons would be preferable with respect to securing a more fixed position for the arc, but when an alabaster inner globe is used the diffusive power of the globe is sufficient to counteract displacements of the arc. The lights are suspended from 12 to 20 ft. above ground, and since alabaster inner globes are used there is practically no shadow. The lamps are hung about 250 ft. apart. One benefit of the low-ampere lamp is that it can be hung lower and therefore a better illuminating effect obtained. The illuminating effect compares favorably with that from incandescent lamps. Mr. W. D'A. Ryan said that adopting as a standard of illumination .006 of a candle-foot, this illumination would be given by a 7.5-amp. alternating-current lamp, if two lamps are installed 490 ft. apart, or by a 4.5-amp. lamp if installed 335 ft. apart. For a given illumination, eleven 7.5 lamps would be required per mile, expending 5,180 watts, and fifteen 4.4-amp. lamps, expending 4,235 watts; or for more illumination between lamps and the same energy, there would be eighteen lamps against eleven. Mr. Wirt said that the number of lamps, number of transformers, circuits, etc., should be included in comparing low-ampere with high-ampere lamps. Mr. John W. Lieb said that in comparing lamps one should go beyond the mere question of illumination on the street and take into consideration also the general effectiveness of the illumination and its brilliancy. Mr. Ryan said that the illumination by reflection from buildings is an important consideration, and consequently in cities it is a question as to how low one can go with units and still derive advantage from distributing power, as compared with the higher efficiency of the larger unit. Mr. Wirt considered there is some distinctive advantage in large light units, and he doubted whether it is possible to get below 4.4 amp. Mr. Hallberg said that while the company now gets $146 for two 4-amp. lamps, he doubted if they could have gotten that amount for one lamp of double the illuminating power. The people prefer the smaller lamps close together rather than large lamps farther apart.

PECK PAPER.

In the discussion of Mr. Peck's paper, on transformer standardization, an abstract of which appeared last week, Mr. Moody, of the General Electric Company, said that his company during the past ten years, has manufactured some 18,000 different transformers, which means 5 to 6 new designs per day. He recommended that engineers should specify standard transformers, and particularly so in the case of new plants. He suggested that the American Institute of Electrical Engineers might be a powerful factor in achieving standardization of transformers, since there is little likelihood of different companies coming to an agreement among themselves as to desirable ratios. He considered that a range of 10 per cent. is usually sufficient in the case of standard taps in large transformers. With a 15 per cent. range he suggested there must be a corresponding increase in the number of turns and in the cross-section of the transformer windings. On the other hand, 5 per cent. taps are in most cases too rough for adjustment. In the case of smaller transformers for lighting, there seems to be less reason for adjustable rates, and it would appear that the feeder regulator rather than the transformer is what should be adjustable for the variable drop in different feeders. His company for some time has made a consideration proportion of smaller transformers with a 1 to 9 or a 1 to 18 ratio. This was not an attempt to allow for drop, but to give 110 volts or more for motors in plants having generators that would not admit of obtaining these voltages under full load. As 2,200-volt generators become more common, the 1 to 10 or 1 to 20 ratio will answer every purpose. Mr. Moody did not favor a permanent adjustment of ratios by taps except in large units, as an adjustment can be made for only one condition of load, and is therefore not a real remedy for variable drop. If such a tap is used to obtain a higher secondary voltage than normal instead of to allow for drop, it is objectionable for the reason that when in use the core loss is approximately 20 per cent. higher and copper loss 10 per cent. less than that for which the transformer was designed. When so much effort is made to obtain a higher "all day" efficiency, a good design should not be thus distorted when it increases the "all day" losses 20 per cent. He said that in a few years at least 80 per cent. of all transformers purchased will conform to some generally acknowledged standard of capacity and voltage.

Mr. Wagoner disapproved of compensating for line losses on small transformers by means of a tap on the primary to give a higher secondary voltage, as this during 20 or 21 hours per day would increase the core losses 18 to 20 per cent. Mr. Lieb said that the preceding remarks did not affect the desirability of having three or more taps on such transformers as are used to reduce primary voltage for a rotary converter, in which case it is extremely desirable to have at least 4 or more such taps. Mr. Hewitt agreed with Mr. Lieb and said that he had found a second tap of value in the case of long lines supplying both lighting and motor loads, through assisting in continuing a fairly constant voltage on the lighting end of the system. The tap is also desirable on the end of a long feeder

carrying a constant motor load, as it eliminates the necessity of adding more copper to the line. Mr. W. G. Carlton said that the Chicago Edison Company has feeders varying in length from one to five miles, and he did not see how they could dispense with taps on the transformers when operating from a common bus. Mr. H. J. Gille, of St. Paul, said that he thought taps on rotary converters are desirable, but that it would also be desirable for manufacturers to connect up all transformers when they ship them, thereby obviating a source of trouble at the station. Mr. H. C. Wirt considered that the question separated itself into a discussion with respect to large transformers and to small transformers. He considered that to adopt a transformer ratio of 20 to 1 or 18 to 1, while it might be convenient for manufacturers, would not strike central station men favorably. An interchangeable ratio may be obtained by having an additional winding on the secondary, which will cause the core losses to remain unchanged, and also to a great extent the copper losses. This method is to the advantage of the central man, but not to the manufacturer. Mr. Peck said that the double ratio of 18 and 20 to 1 was an advantage to the manufacturer, because it spared him from carrying two kinds of transformers. Taps on transformers are an excellent thing and never go amiss, as there are constantly instances where they can be used to advantage, and where new winding would be required were they not present. Mr. Moody said that the use of two ratios in a single plant makes it impossible to obtain the right voltage at any one place under all conditions of load, and there is a temptation to make connections to a transformer tap rather than to correct the feeder to keep the drop at the proper amount. As to three secondary voltages, the additional cost of having three rather than two is not great on a transformer of any considerable size, and it is in these cases that it is really desirable to use the third ratio, since few small motors are wound for higher than 220 volts. On the smaller sizes where the cost of three voltages adds materially to the expense, there is little or no call for voltages higher than the normal.

BEMENT PAPER.

The discussion of the paper of Mr. Bement, giving the result of some boiler tests, an abstract of which was printed last week, was opened by Mr. W. L. Abbott, who dwelt upon the importance of the boiler room, which he is convinced is the beginning, if not the end, of the central station man's success and trouble. If all the heating surface of the boiler could always be brought into use, it could be worked at great capacity with the same efficiency than is ordinarily done. He gave an illustration with respect to a common tubular boiler, in which most of the gases of combustion pass through the upper row of tubes and very little through the lower rows. He advocated a proper distribution of the draft so that the gases would be made to travel through all the tubes equally, and the same remark applies to a water tube boiler. In referring to smoke production, he said that during the past winter the Chicago plant burned coal at the rate of three-quarters of a ton a minute without producing the slightest cloud of smoke above the stacks. There is no special care taken in firing to prevent smoke, but from the construction of the furnace it takes all the coal that can be fed to it and burns it completely. Referring to another case, where there was much smoke, he said the cause was that the gases came in contact with the cold boiler surfaces before the combustion was complete. Mr. John W. Lieb said that the conditions in many of the Eastern cities are such that the best results are not obtained from the use of soft coal, more steam being generated per dollar from anthracite coal. He said that in the New York Waterside station better results are obtained from burning No. 3 buckwheat coal with hand firing than from using soft coal with mechanical stokers. In New York at one time forced draft of 1½ in. to 2 in. of air pressure was used, giving rates of combustion of from 30 to 40 pounds of coal per square foot of grate; no unusual depreciation of the furnace or boilers resulted, and the efficiency obtained was such as to make it worth while to do a very considerable amount of forcing during the time of peak load. In reply to an inquiry, Mr. Bement said that where the air supply is large and cannot be controlled it is better to use more coal and make more fire, this obviating the loss from excessive air supply. Mr. Alex. Dow said that a furnace, to give the highest efficiency, must be designed for the kind of fuel that is to be burned in it. Different coals require different proportions of combustion chambers, and different handling on the grates. He approved highly of the use of the tiled furnace construction for the reason that it provides a hot, long and large combustion chamber for the free burning of soft coals, and cuts off the cooling effect of the tubes. He considered that stokers can be recommended if the fuel which they use has a coking quality, but different types of stokers are required for different kinds of fuel. He said some stokers will not feed small buckwheat; there is a possibility of constructing a stoker which will burn any kind of fuel fed to it, but that such a flexibility would be obtained at a sacrifice of efficiency.

REPORT OF COMMITTEE ON DISTRICT HEATING.

Mr. John W. Glidden presented the report of the committee on district heating, which opens with the statement that there are about one hundred heating plants of this character in operation in the United States at the present time, possibly ten of which are live steam heating plants doing only heating; of the remainder, about two-thirds are exhaust steam plants and one-third hot water heating plants. A list of questions was mailed to all of the plants, from which fifty replies were received and the accompanying table shows some of the data compiled from the reports received.

No.	Investment in heating plant.	Heating revenue.	Price of coal.	Labor and fuel for heating.	Total coal.	Back pressure.	Net revenue percent. of investment.	Remarks.
1	$75,000	$26,000	$1.00	$12,000	$31,536	3-15	18.7	Day load.
2	4,800	2,000	2.40	.....	.....	0-0	...	Water-power.
3	12,000	3,200	1.75	.....	.....	2-5	...	No day load.
4	33,000	2,293	1.25	.....	5,838	0-3	...	Day load.
5	67,738	26,449	1.58	20,916	27,594	3-20	8.2	Day load.
6	5,000	1,000	1.25	.....	.....	0-0	...	No day load.
7	40,000	Just std.	2.15	.....	.....	0-0	...	Day load.
8	15,000	6,500	1.70	3,000	8,148	0-0	23.3	Day load.
9	.....	43,000	...	14,800	.....	5-18	...	Live St. only.
10	16,000	3,712	2.00	.....	.....	0-0	...	Day load.
11	66,159	15,843	...	13,282	7,185	...	4.0	Live St. only.
12	30,000	3,170	2.25	.....	.....	0-0	...	New plant.
13	.....	.....	5.00	.....	.....	...	...	Sore spot.
14	48,000	10,000	.90	.....	.....	2-5	...	Sore spot.
15	10,000	2,642	1.35	1,414	4,950	1-3	12.3	Day load.
16	6,000	1,906	2.10	.....	3,509	1-5	...	No day load.

NOTE—Isolated office buildings use 100 pounds good Illinois coal per square foot of radiation during seven months heating season.

The conclusions of the committee are that it finds no evidence that the business is generally profitable; that there is lack of information among heating managers, and a lack of enthusiasm for the business, and little separate accounting. There is a genuine demand from the public for the services, and if the central station does not occupy it directly it will be occupied by others. Central stations are the best to meet the demand, first, because of some available apparatus already installed; second, because they possess the technical knowledge; third, because they possess the organizations; and, fourth, for their own self-protection.

Mr. C. R. Maunsell said he could not endorse some of the statements in the paper referring to the heating business. He said that in his town the demand for steam heat greatly exceeds the capacity of the company, which has had very good returns in a financial way from its heating business. Mr. D. H. McGee, of Red Oak, Ill., suggested the appointment of a committee for obtaining further information concerning steam and hot water heating by testing actual plants. He operates a hot water plant, and said that within the past four years he has answered no less than 600 letters of inquiry from all over the country, and has had personal visits from managers from every State from Kentucky to Washington. He considered that it would be to an advantage if a fund were appropriated for testing a certain number of steam and hot water plants. Mr. W. Walbank, of Montreal, Can., gave the result of an investigation in Montreal of the steam heating question. The result arrived at was if coal could be gotten for nothing and attendance for nothing, the receipts would not pay the interest on the pipes alone. Mr. Maunsell said the reason for this showing was that the plant was to be one sending out live steam. Last winter, he said, his plant had a revenue of nearly $15,000, which was sufficient to pay all the coal bills of the plant for eight months and leave nearly 4 per cent. interest on the money; the operating costs of the steam heating were only about 30 per cent. of the gross revenue for heating. Bills are made out from meter readings. In six years' use there has been practically no trouble, no cost for repairs, and no deterioration has been noted. Mr. James E. Pyle, of Westchester, N. Y., gave an account of his experience in steam exhaust heating, which gave satisfactory results. He considered it just as necessary to sell heat by meter as to sell electric light by meter. Mr. H. J. Gille called attention to the fact that

Prof. Carpenter, of Cornell, has given in a book the results of many tests of steam and hot water heating. Mr. McGee thought it was desirable, nevertheless, to make a general investigation of all systems; he said that last year the income from the investment of his company in steam heating was 23 per cent.; 6 per cent. is figured for depreciation and 6 per cent. for interest. The district served is a strictly commercial one, and the station is situated in the heart of it with a large building every 22 feet. At present there are 1½ miles of mains and 50,000 feet of radiation. Mr. G. W. Bryan, of Atlanta, Ga., said that during the last steam heating season, his company, with 15,000 ft. of mains, supplied 200,000 sq. ft. of radiation, and while he does not think any money was made, nevertheless the steam heating business is of great service in keeping out isolated plants. In closing the discussion President Ferguson referred to the difficulty experienced in obtaining information from members on the subject, and said that it might be well to stop the investigation unless members of companies which were members of the Association and using the system, were willing to give information they possessed for the use generally of other members of the Association.

TACTFUL RELATIONS WITH CUSTOMERS.

Mr. John W. Ferguson, assistant to the contract agent of Chicago Edison Company, dwelt upon the desirability of keeping on good terms with customers. A question to-day seriously occupying the attention of the public—and one that, if not provided against by the just and tactful treatment of customers, will surely in the near future play an important part in our political life—is that of municipal ownership of public utilities. To meet this issue, the central station management should show by their methods in operating that the companies fully recognize the limitations as well as the privileges vested in their franchise rights. The responsible head of any company should, therefore, see to it that there are placed at the head of the various departments men who will realize the necessity of tactful treatment of those with whom they come in contact. From the office boy and the elevator conductor, through all the ramifications in the organization of a big company, up to the president, upon each and every one depends the reputation of the company and its popularity, or lack of it, with the public. He dwelt upon the misuse or careless use of the telephone, to which is due much of the ill feeling exhibited by the public toward public service corporations. The minor clerk or office boy often conceives an exaggerated idea of his own importance, which he displays when using the telephone; these should be schooled to answer calls with patience and politeness. Upon the contract agent, the inspector, the collector, the meter reader and the repair man devolves most closely the duty of maintaining friendly relations with customers. Mr. Ferguson advises that central station managers should be careful in their choice of men for these positions and particularly for that of agent.

Mr. Leon Scherck, of New Orleans, recalled an incident in his city where one of the smaller companies was threatened with a loss of one of its largest customers and also a law suit, simply owing to a remark of one of the telephone boys. He considered that the greatest care should be exercised in choosing the head of the soliciting department, and he thinks it almost necessary at the present day to put in charge of the contract department a man who has some knowledge of electrical engineering, though not necessarily an expert engineer. Mr. John F. Gilchrist coincided with Mr. Scherck on this point, and said that too often the men who are at the head of the business know but little of the details of the handling of their customers. Mr. Arthur Williams expressed his gratification that associations all over the country are now giving more attention to this question of "commercial engineering," which term has been adopted by the General Electric Company and one or two of the other large manufacturing companies. Mr. C. S. Rogers, of Youngstown, Ohio, emphasized the necessity of promptly investigating all claims and said it is too often the case that the superintendents, not being responsible for the collection of accounts, do not give prompt attention to the investigation and adjustment of complaints. Mr. C. L. Wakefield, of Dallas, Texas, thought that the contract department often makes a mistake in having too many words in the contract. The trouble could be avoided by making a contract as simple as possible, so long as the price and term of contract is stated. Mr. E. F. Phillips, of Detroit, said that it was the practice of his company to tell the customer the truth at all times, regardless of whether the customer was lost or retained; and to acknowledge that a meter was too fast when that was the case. Mr. C. M. Lewis, of Bellevue, Ohio, said that in a dispute concerning a meter reading, the customer would be asked to put in place a new 16-cp lamp, try it for several hours and then check the watts with the meter reading.

RELATIONS WITH EMPLOYEES.

Mr. Arthur Williams presented a paper giving an account of the provision that had been made by some large corporations for the permanent welfare of their employees, and detailing at length the Brown system of discipline. The paper also discussed the matters of pension and relief funds. In conclusion, the result of the investigations recently made by the New York Edison Company concerning the organization of a relief association is given. The plan suggested is that each member shall pay three per cent. of his wages and in the event of accident or illness shall have half of his wages or salary, and in the event of his death his heirs shall be paid $350; that the company shall pay to all employees serving continuously for a period of twenty-five years an annual pension of one per cent. of the average salary or wages received during the preceding ten years. As in the case of the Pennsylvania Railroad Company, the intent is to place a limit upon the total expenditure of approximately $3.80 annually for each employee on the pay roll. The paper gives extracts of the opinion rendered on the subject by the attorneys of the New York Edison Company.

In reply to a query, Mr. Williams said that he has not found any objection on the part of men to the additional payments made to benefit funds, because they are entirely voluntary and the men get a great deal more than they take. He knows of no company which requires any employee to join a benefit organization. Pensions, however, are administered entirely by the employer and are given to each employee whether he belongs to a benefit organization or not. There is no necessary relation between the sick and insurance organization and the pension system.

DECORATIVE AND SIGN LIGHTING.

Mr. Arthur Williams submitted an elaborately illustrated pamphlet to illustrate the different kinds of decorative lighting. The pamphlet contains more than eighty excellently executed half-tone engravings, some of which are printed on toned background in order to bring out a light effect. The illustrations show some of the most noted achievements in recent years in this class of lighting. On a double page is artistically printed "A Ballad of the Signs of the Times," by Carolyn Wells, the sentiment of which is that "The signs of the times are electric signs." This handsome pamphlet will be of much value to central station men wishing to work up the decorative lighting part of their business.

THE YOUNG ENGINEER IN THE ELECTRIC PLANT.

Mr. Charles F. Scott, in a paper, presented a plea for a proper technical supervision and direction of central station properties. There is, he said, apt to be a false tendency to an economy which rates brains too cheaply and fails to advance the intelligent young man. He gave instances showing the effect of good and poor supervision and laid down the qualifications necessary to the engineer of a central station. Such a man needs not only to be a steam engineer, an electrical engineer, and an all-around electrician, but in many cases he may have to do with hydraulics and gas. The type of man for the central station is a man who has a good foundation and has the power to develop. The man who has a good active mind and a sound theoretical basis, with even a small measure of practical experience, is capable of dealing with new questions in an intelligent way. We will probably find if we examine the ranks of the successful central station engineers, that as a rule they are technically educated men who have had their first years of practical training in a manufacturing company. Mr. Scott believes it is a mistake for a graduate to take office work at once, for what he needs is practical work, with overalls and grease. The vast interests of, and enormous capital invested in, central stations are increasing at a rapid rate; more men are needed, more men will be needed and those connected with the central station interests should as companies or as individuals do all they can to promote the development of the best apparatus, the best methods and the best men.

In the discussion of Mr. Scott's paper, Mr. W. B. Jackson emphasized the point brought out as to necessity of broad knowledge on the part of the electrical engineer. As to the remark about the young engineer knowing what overalls, grease and dirt are, he thought it well to go one step further and bear in mind that the young engineer who allows the dirt to remain upon him is apt finally to drop back into the position of dynamo or engine tender. He has been impressed and pleased by the efforts of those training young engineers to teach them the necessity of being a man, a well rounded man, as well as simply an engineer. The fact that not so many years

ago a man who knew a little of engineering and a little of electricity made an excellent man to take charge of an electrical plant, does not apply at the present day. Mr. John F. Gilchrist considered that the young man who wishes to make progress in the central station business should be careful to obtain a very broad grasp of the business, especially in the smaller companies. Engineering schools should give more prominence to the business end, to the contracting, accounting and investment ends, and the proper charging of investment cost as in comparison with operating cost, in order that they may be able to determine what the property is doing and whether it is doing all it should. Mr. James I. Ayer said the engineer's training has only been started when he leaves college, and to perfect himself in the practical side of his work requires four or five years in the mechanical part of the business, during which time he should disregard in a large measure the fact he had been trained as an engineer, and go to work as a mechanical man to learn his trade. He deprecated graduates going into the office, where many of them wish to start. Mr. John W. Lieb said that an electrical engineer should be one who has first been grounded and developed as a mechanical engineer, the electrical features subsequently being added. He considered that the electrical courses of to-day are apt to develop electricians rather than electrical engineers. The proper course would be one in mechanical engineering with incidentally some electrical work, and then a one year's course of specialization in electrical engineering studies. He dwelt upon the necessity of the young engineer being able to present his ideas in a clear, concise form, so as to convince his employers of the strength and cogency of the arguments which he offers. Prof. H. E. Clifford seconded the opinion of Mr. Lieb that the electrical engineer should have a sound mechanical engineer's foundation, and said that at the Massachusetts Institute of Technology such a foundation is given. He differed with Mr. Ayer concerning the desire of students to begin at the office end of electrical work. Prof. W. L. Robb said that many central station men expected perfection in the young graduate of twenty-one, whereas a young man fresh from technical school cannot be expected to give better service than is obtained in the hospital from a young graduate from the medical school. Broad-minded engineers cannot be obtained in young men of twenty-one or two. He thought that technical school graduates ought first to be engineers and later become electrical, mechanical or civil engineers. He thought there were too many kinds of engineers at present and that engineering is now divided into too many departments.

Mr. W. M. Anthony considered that one of the greatest handicaps to the young man going into the central station is the attitude of central station managers in withholding information from them, and entered a plea that young men entering into work after graduation should be given a better chance than what they are at present. Prof. Goldsborough said that while he agreed entirely that engineers should be broad men, unless sentiment develops which will allow more than two years' training of engineers, it would be impossible to give them the amount of special training that they need. It is impossible for any man at the present to fully digest all the knowledge pertaining to civil, mechanical and electrical engineering in four years. In his opinion, the young engineer of the future will have four years of general engineering training along all lines, then two years of specialized training.

OFFICIAL METHODS AND ACCOUNTING.

Mr. W. M. Anthony presented his report as chairman on this subject in the form of two handsome pamphlets. One of these is a large page pamphlet containing reproductions of twenty-six kinds of office forms, instructions for use of which are given in the second pamphlet, which also discusses generally the subject of central station accounting.

The discussion on Mr. Anthony's report was one of the features of the convention, both in extent and interest. Mr. Doherty disagreed with Mr. Anthony as to the advisability of meter readers being kept informed of previous readings. His practice was not only to keep this information from meter readers, but to rotate the readers among the different districts month by month. He considered that broad principles of accounting are yet to be learned by central station men, and he drew a distinction between intelligent accounting and mere bookkeeping; a bookkeeper means a copyist, and what is needed is a thinking man to do accounting. According to the system of bookkeeping of his companies, two days from the last meter reading the earnings of the company for the preceding month are known. Errors of meter readings and errors of bookkeepers are posted on a bulletin card in the bookkeeper's room. The errors of meter reading have been reduced from eight mistakes per 1,000 meters read, to one mistake per 2,500, which has been the average for the last month. Mr. Anthony disagreed with Mr. Doherty concerning the entries on meter cards, his experience being that the more employees know of the details of their work, the better off is the company, and that the more the meter readers know of the customers' readings, the more they are apt to ascertain anything peculiar about a meter and report to the meter department. In replying to a query, he stated that loose-leaf ledgers are considered as legal evidence in courts of justice.

Mr. Samuel Insull spoke very strongly on the subject of proper accounting systems. He said that in his experience in dealing with small properties—and he deals as extensively with smaller properties as with large ones—he seldom found that those running the properties knew whether they were making or losing any money. He has found cases of electric lighting plants, the owners of which found they were losing money and got out of business, whereas if they had had a proper accounting system and proper methods, and knew where they stood from month to month, they would have found that they were making money. A proper system of accounting for the smaller companies would cause the electrical securities of these companies to stand higher, which would reflect favorably on the securities of larger companies. He said that last year he bought ten small central station properties, and in a number of cases he was enabled to buy at prices lower than the properties were really worth, for the reason that no proper system of accounting had been employed and the real value of the properties was not known.

In replying to a query, Mr. Anthony said that every official should be given the widest information, and that nothing should be held back, particularly as men are apt not to have any idea of the commercial value until that value is shown to them in dollars. Mr. W. S. Neuman considered that it was an advantage to the meter reader to have the previous reading of the meter. In reply to a question as to whether the storekeeper should be under the direction of the auditor of a company or the manager, Mr. Anthony said that the auditor should have direct charge of every department relating to showings of cost, receipts, interests or disbursements and general charge of every department as regards the obtaining of results. The storekeeper should come under the direct jurisdiction of the manager, for if he does not do his work the auditor is liable to call on the manager. He considered that all accounting should come in the accounting department proper, that the storekeeper should keep no accounts except with respect to quantities, and that the same was true of any employee or head of a department, as prices do not come within their category. The pay rolls in Chicago are kept in the same way, the number of hours on work, kinds of work, and places where done, being entered, the man who makes out the pay roll not being supposed to know the wages received by the men. In this way maximum efficiency is concentrated in each department where it belongs. Mechanical men should not be made storekeepers nor operating men bookkeepers.

Mr. F. E. Smith, of Somerville, Mass., said that in the case of his company, which had less than 500 customers, the meter reading was written on the customer's bill, and the bill collected at once if possible. If this could not be determined, the bill was left and a stub torn off, which was taken to the office from which to make the necessary entry there. Mr. J. F. Strickland, of Waxahachie, Texas, said that the average man connected with a small station should know only that part of the business that pertains to his personal responsibility. He should know this well, but not necessarily know the business of other men connected with the company. His company required a deposit to the full value of the meter installed.

Mr. Anthony did not consider it advisable to exact deposits for meters, and said that the less the deposit question is stirred up the better it is for a company. Where there is doubt, his company rents the meters weekly, as in that case a default would only be one week's bill. When asked why he did not use the prepayment meter instead of collecting bills weekly, he replied that it was because one had so many kinds of customers with different ideas to deal with. If customers can be obtained by the use of a prepayment meter, such a meter goes in; if the weekly system suits them the best they get that, being given their choice as at a lunch counter. His company had 30,000 customers and only $20,000 on deposit, and interest at 5 per cent. is paid on the deposits. Mr. E. F. Peck testified to the efficiency of Mr. Anthony's system as adopted at Schenectady, N. Y. Formerly he used to look forward to the showing at the end of a month with a great deal of anxiety, and now the end of a month is

welcomed. Through the adoption of the system, the operating expenses have been decreased something like 8 per cent. Mr. Arthur Williams said that the New York Edison Company had not yet found any prepayment meter which gave entirely satisfactory results, but that it would welcome a reliable meter of this type. Mr. John F. Gilchrist, of Chicago, said that the Chicago Edison Company had from 225 to 250 prepayment meters in use. It was found that many people are unwilling to make a deposit, others are unwilling to agree to a minimum charge of one dollar a month, and to these the prepayment meter was offered. In a month or so the customer is generally found ready to make an arrangement on regular contract basis.

The discussion also took up the matters of addressing and computating devices and details of accounting organization. An enlivening incident was a tilt between Prof. Bemis and Messrs. Insull, Scovil and Bean. Mr. Scovil accused Prof. Bemis of misrepresenting the cost of producing electric current, and Mr. Bean, of St. Joseph, Mich., said that these misrepresentations had interfered with his business financially. Prof. Bemis, while disclaiming technical knowledge, said that he felt justified in writing as a statistician on central station matters; and so far as the misrepresentations to which Mr. Scovil referred were concerned, his remarks should have been directed at a report made to the City of Cleveland, which he had merely forwarded without endorsing the statements as to price which it contained.

ADVANTAGES TO BE DERIVED FROM CONSOLIDATION OF ELECTRICAL INTERESTS.

In opening his paper with the above title, Mr. Sydney Hosmer classified the advantages to be derived from any form of consolidation of manufacturing interests as follows: (1) The advantage of the lower capital investment, (2) lower cost of production, and (3) better service. To these should be added, in the case of the transmission of electrical energy, the advantage to be derived from an improved load factor, which is almost certain to result from a combination of different classes of business. This improvement of load factor, of course, affects the matter of capital invested and also cost of production, but it is an advantage which applies to electrical consolidations in addition to those which may apply to any other forms of consolidation. In all other cases where such consolidations have been effected, still another point has been gained, though it is not due to the mere combination. That is, small plants have an most every case been old and equipped with inefficient apparatus, while the consolidated plant has been of the most modern type and built under such conditions that the best engineering talent was available.

In the matter of invested capital, actual figures are hard to obtain. Taking the generating plant itself we know that plants of 15,000 to 20,000-kw capacity can be built for $90 a kw, while plants of approximately 500 kw run as high as $200 or over, due, of course, to the smaller units employed. Going above 30,000-kw capacity, the comparison would not continue to show such marked gain.

It is the almost universal practice to-day to run everything from one station, using sub-stations for the transformation necessary for the supply of local districts; this may be proper as far as it has gone, but a point will be reached where the cost of lines and sub-stations, with the liability to interruption in each, will not only justify, but demand a number of generating stations located with reference to the demand for current. The question of when this will be justified will depend entirely on coal and water facilities.

There is a limit to the amount of power it is desirable to put in one building. It has been demonstrated a number of times in our large stations that accidents can happen which will interrupt the entire plant. What this amount should be will depend largely on the character of service supplied. On the other hand, it should be as small as possible, so that any accident may affect as small a percentage of supply as possible; on the other hand, it must be large enough so that any possible demand for current can be met without difficulty. A plant supplying feeders of normal capacity of 700 or 800 kw could be divided into units of 10,000 or 15,000 kw without sacrificing any of the advantages of ample generating capacity, while a plant supplying feeders of 2,000 kw would have to be made in larger sections to give equal service.

In most cases it will be impossible to find a number of locations having good coaling and water facilities, so that a subdivided plant at one point may be preferable, but of course aside from coal and ash-handling machinery, there is no argument from the investment standpoint to justify putting all the plant at one place, while on the other hand, distribution investment might be very much reduced by a number of generating stations at different points, provided always, of course, coal and water can be obtained. The Boston Edison Company is now erecting a plant for an ultimate capacity of 50,000 or 60,000 kw; the situation there with reference to coaling and the shape of territory supplied is such that there is no choice but to locate the entire plant at one place. It is, however, the intention to absolutely divide that plant into at least three divisions, even cutting the bus-bars for the separate divisions. Of course arrangements will be made for connecting the bus-bars that they may be all supplied from one section at period of light load.

Turning now to the question of lower cost of production, we find in station cost alone a very marked gain, amounting to a difference of 500 or 600 per cent. between a plant of 500 kw and one of 20,000. In this respect, improvement should be found in consolidation, continuing almost in the same ratio no matter how large the plant may become. A subdivided plant may cost a little more to operate than one not subdivided, but the difference will scarcely be appreciable. This would be almost as true for a number of generating stations if they were properly interconnected.

In the distribution of the consolidated company there might be some small gain in expense, but it could not be a very marked one. This expense is a function of the number of subscribers, and miles of wire. In the consolidation, the miles of wire would certainly be increased for the same customers with consequent increase of expense of maintenance. If anything were gained here, it would probably be at the cost of increased investment; that is, the larger company would instal distribution plant perhaps better and in a more lasting way, but at greater cost.

In general expense and management, we could hardly expect much improvement, owing largely to the fact that responsibilities are largely increased and more complicated legal questions are brought in. Taxes would, of course, be decreased in such measure as we have saved investment.

Turning now to the quality of service, we find the small company almost invariably running without spare apparatus and the service liable to suffer if anything goes wrong. This is probably partly due to the fact that it is a greater burden for the small company to buy extra apparatus, but it is probably in a greater measure due to the character of management under which it is run. The management of the larger company has a greater appreciation of its responsibilities and realizes more thoroughly that development depends on reliability of service. This defect goes with the smaller company because it is smaller and the margin of profit is less, and less can be put into management, etc., and not as may be argued because the company is old-fashioned and poorly handled. Another defect which we find in most of the small companies and which is not due to the mere fact that they are small is the absence of modern methods and devices, owing to the fact that the plant usually is old and capital is not always available to take advantage of the newest developments.

The question of 24-hour service also comes in. In a 500-kw plant it costs as much to run one unit as it does the whole station in all except coal, as there are at most only two or three men to a watch, consequently, the long hours at very light load are an impossible burden. On the other hand, the cost in a large station varies in all things approximately with the number of units in use, and kilowatts produced at light load times bear same relation in cost to those produced on the peak. The difference in load factor between a small and large company comes in here also. A company supplying a great territory included a number of different classes of business—residences, amusements, factories and possibly street railways, so that the cost per kilowatt may be just as good at one part of the day as another. Also, one company taking the place of several does not necessarily get the sums of the peaks of the different stations as these may not coincide.

In the discussion of Mr. Hosmer's paper, Mr. Junkersfeld, in referring to Mr. Hosmer's opinion, that it is advisable to instal a number of smaller stations as opposed to one large station, said that the machinery in the present old stations operated during a few hours of a few months of the year is worth just as much to the central station as an equivalent capacity of machinery in a new station. Taking the situation in a large city, the more power electrically generated in one locality, the less will be the amount of unproductive investment to be carried, and the less amount of unproductive labor. As to the cost of sub-stations and distributing expenses, the transmission investment rarely runs higher than 6 per cent. of the total investment of the company, so that the location of the large station

where the transmission voltage is high enough to be economical does not cut such a big figure. The low-tension distribution network will be very near the same regardless of the number of generating stations, if these stations generate at a higher voltage and the current is distributed through sub-stations. At present the location of the station is very much more independent of the location of the load than formerly. As to the reliability of service in the large station, it means a much better class of machinery and better construction work than heretofore. Reliability, however, may be assured through the use of storage batteries, the subdivision of the station and proper control of the service. He considers that the tendency towards subdividing the station will increase. Mr. John W. Lieb, Jr., coincided with Mr. Junkersfeld as to the influence of unproductive labor and secondary cost in a multiplicity of small stations as against one large power plant. It is of extreme importance for the large central plant to be guarded with more than usual care against fire and interruptions of service. It is probably true that the best arrangement and relation of sub-stations to the large central plant has not yet been fully developed. Questions still open are whether single or two-bus operation is the better, the separation of switch gear, or a still further separation into practical single-unit operation to groups of sub-stations. It is probable, however, that supplying each sub-station through independent sets of feeders, following two courses, and having the central station arranged so as to secure two-bus operation, will supply a reasonable amount of safeguard without detracting too much from the economies to be obtained from multiple-bus operation. He referred to the extreme importance of an adequate storage battery equipment as a safeguard from short interruptions in service.

THE STEAM TURBINE.

Prof. W. L. Robb made some remarks from notes on the steam turbine, at the conclusion of which President Ferguson introduced Mr. W. L. R. Emmet as one who is entitled to great credit in bringing the Curtis turbine to its present state of development, and its application to electrical generation. Mr. Emmet said that in view of the prominence thus given to his name, he wished to refer to the great value of Mr. Curtis's work on the steam turbine. The work at Schenectady, which has not been his alone, has been in connection with the mechanical development of the turbine, and also in the development of the methods of making it economical and proportioning it, and this has resulted largely from the facilities there afforded for persistent experimenting. Mr. Curtis is the inventor of the turbine and his ideas have been very clear and distinct. Mr. Emmet then gave a sketch of the principles of the turbine as developed by Mr. Curtis and pointed out that in the Curtis turbine the water due to expansion is taken out in successive stages in more or less proportion, and does not take part in the subsequent expansions; consequently all the superheat that can be used is available and acts sufficiently without having to expend its energy in re-evaporating water. Experiments with the Curtis turbine have shown that the elimination of initial moisture or moisture at any stage by the addition of superheat is beneficial to the turbine, and the improvement in increased superheat is indefinite, being represented almost by a straight line. Hopes as to the future economy of turbines of this type are based to a great extent on the proper elimination of the moisture and the proper use of superheat.

He said that large turbines and small turbines were nearly equally efficient, but it is hoped that with the large machines there will eventually be great improvements in efficiency, for the reason that a certain amount of clearance is necessary for mechanical reasons, and that clearance can be made less proportionately as the turbine increases in size, while the leakage and dissipation from improper fittings will be relatively less, as well as friction and radiation losses. A turbine of 600-kw capacity showed an economy of 19 pounds of dry steam per kw-hour at full load, and only 1½ pounds greater at half load. Mr. Emmet said that in turbines the increase in economy has been about 1 per cent. for every 12 degrees of superheat. In a turbine of the Curtis type, the capacity is practically unlimited without any increased expenses, because by simply adding more nozzles, more power can be gotten out of the turbine. The economy would fall off somewhat with great overloads. Back pressure is rather more objectionable in the turbine than in the steam engine, and the turbine is relatively less advantageous in non-condensing than condensing. One of the great advantages of the turbine is in its ability to use high degrees of expansion, and when working non-condensing this advantage is lost. Up to the present time little or nothing has been done toward competing with the non-condensing engine, the details of commercial turbines being worked out on the condensing basis. In reply to a query Mr. Emmet said he thinks the gas engine has a future, but it is expensive to build and maintain and the same is true of its accessories. Turbines do nearly as well as the gas engines, and he thinks the latter will receive a great setback because of the development of the steam turbine.

Mr. Edward Yawger, of Pittsburg, Pa., said that the floor area at present actually used by turbines is about twice greater than is necessary. It has been suggested that the surface condenser should be made a part of the foundation of the turbine, but the objection to this is that it would necessitate the turbine manufacturer being also a manufacturer of the condenser, and it might possibly restrict accessibility to the condenser. Owing to the turbine occupying such a small space it can be set up on temporary foundations and thoroughly tested under load before shipment. In the Westinghouse shops the testing room contains foundations of a sufficient size to take 5,000-kw turbines, and there are also surface condensers of large capacity, pumps, an independent superheater, etc. It has been the practice so far of this company to thoroughly test every turbine, not only at full loads, but at smaller loads, down to ⅕. Up to the present some 500 such tests have been made on turbines.

Replying to a question, Mr. Emmet said that owing to the great expansive limit of the turbine, it is much more efficient at high vacuums than the steam engine. He said that in the smaller turbines the clearance is .03 of an inch and .05 of an inch in the largest turbines, which clearances are found to be ample. One of the objects in building the turbine in vertical position is to make it short, to simplify the bearings and render expansion of the metal unimportant. The pressure on the step bearing is governed by the size, it being 300 pounds per square inch in the smallest turbine and about 1,100 pounds in the largest machines. In reply to a question as to heating of the generator, he said that since the steam is expanded down to atmospheric pressure before entering the pressure shell, the temperature is only about 212°; and since there is vigorous ventilation in the rapid moving machine of this kind, no trouble has been experienced from the effects of heat.

RELATIVE ADVANTAGES OF ELECTRICAL AND MECHANICAL METHODS OF VARIABLE SPEED CONTROL FOR GENERAL POWER SERVICE.

Mr. William Cooper, in a paper on the above title, discusses the advantages of the several methods of obtaining variable speed control, and contrasts mechanical control by the use of cones, change gears, etc., with direct electric control, most of the advantages being in favor of the electric drive. The various systems of electric control are described, and it is pointed out that in installing a new manufacturing plant the two important considerations are as to what system will assist in yielding a maximum output from the machinery installed, and the comparative costs of the different methods installed. The following rules are given for determining the relative size of motors for constant horse-power application:

First—The total range of speed, using both variable voltage and field regulation, will be as the square of the range of voltages.

Second—Change of horse-power will be directly proportional to change of voltage on armature, field being constant.

Third—Change of horse-power by change of field strength will be inversely proportional to change in speed, voltage on armature remaining constant.

Fourth—Relative size of motor, as referred to the maximum speed, will be directly proportional to its speed variation when using variable voltages.

Fifth—The relative size of motor, as referred to the maximum speed, will be as the square of the speed variation when using field regulation.

Mr. A. W. Lloyd said that in Chicago the cost of driving machinery by gas engines is about the same as with electric motors, but the latter have greater advantages otherwise. The Chicago company takes out a great number of gas engines every year and replaces them with electric motors. He considered that from the central station standard, at the present time a motor will answer all purposes operating on two voltages with resistance in the field and perhaps also in the armature. He considered that the installation of small motors for groups of machines is more economical than the individual drive. Another objection to applying individual motors to old tools is that the tools are generally too light in construction. In the case of very large and heavy machines, however, the individual motor is preferable. Mr. H. M. Lyman, of Chicago, called attention to the advantages of the three-wire distribution and special motors over

the four and five-wire systems and standard motors. The voltages of the three-wire system applied to the armature of a special motor permit a perfectly gradual one-to-four variation of speed. A two-to-one variation is ample for planers, slotters, milling cutters and many other tools. Lathes and boring mills require in extreme cases four-to-one variation of speed on a single job, while on different jobs a range as high as one to 12 or 16 may be required. As the cutting speed of the tool is pretty nearly constant, regardless of the rotative speed, the power taken by a machine is nearly constant for all motor speeds, and the motor must, therefore, be large enough to deliver full load at the lowest speed. It is better to have one of two changes of speed by gearing, than to furnish a motor capable of a full range of speed. The four or five-wire multiple-voltage system had signally failed in cases because the motors were not sufficiently large to furnish the power required when running at their lowest speed.

Mr. H. G. Gille said that in using a variable-speed motor on the three-wire system, unless the neutrals cared for the capacity of the outside feeders, there is likely to be trouble. Mr. Lloyd stated that in Chicago motors of a capacity as high as 15 hp were operated on the regular street system, and that recently a 30-hp motor was installed, but close to a sub-station. Mr. Cooper doubted if the five-wire motor system had failed in any individual case for the reason given, and added that the use of the system was largely increasing. Mr. Arthur Williams said that the experience in New York was that at present prices for electric current for power, there is no chance for the gas engine in competition with the electric motor. He cited an instance where a gas engine that was about to be installed would have cost $3,500 a year to operate, whereas electric current for the same service had cost only $2,700 per year. During the last several months the New York Edison Company has taken out an average of from six to eight gas plants a month. Mr. John W. Lieb considered that the experience of central stations was entirely at variance with the statement that the gas engine is a competitor of the electric motor. Mr. F. W. Borne, of Kenosha, believed that the matter of competition between the gas engine and the electric motor was not only a question of the cost of gas and price per kw-hour of electrical energy; that there were cases where customers would be willing to pay ten times more for electric power than for gas engine power. Mr. Williams stated that a gas engine cannot be run on 20 ft. of gas per hp-hour, and he knows of no test where they consumed less than 30 or 40 ft. of gas per hp-hour. Mr. C. W. Coiner, of Oneida, N. Y., said that in Oneida his company controlled both the gas and electric plants, and while they were selling gas for power purposes for $1.00 per thousand, and current for motor purposes from 10 cents down to 2 cents per hp-hour, yet the motor was almost invariably preferred for power as against the gas engine. Mr. H. T. Hartmann, of Philadelphia, related that in Canton, Ohio, where natural gas sells for 25 cents per thousand, which gas, moreover, is more efficient for use in gas engines than manufactured gas, his company has over 900 hp of electric motors connected in the town of 30,000 inhabitants. Customers find that the reliability of the electric service is more important to them than the cost. Mr. F. J. Pearson, of Chicago, considered that for driving machine shop tools and devices of that character in manufacturing plants, the two-voltage system has proven to be entirely satisfactory. He said that recently two gas engines were replaced with motors, and it was found that the item of labor in the case of the gas engines was 65 per cent. higher and the cost of oil and other materials 50 per cent. greater. Mr. F. E. Smith, of Somerville, Mass., gave examples where gas engine power was replaced by electric motors, and where a reduction in total expense of power followed; and in one case where the cost of electric power was considered greater, the customer was satisfied, owing to the better service. Mr. Harold Almert, of Oak Park, Ill., related that at a recent meeting of mechanical men in Chicago a conservative gas engine representative stated that he had ceased representing that gas engines needed no attention and that he would not now guarantee engines unless an attendant of superior intelligence to that of the ordinary steam engineer was put in charge of the plant.

FUNDAMENTALS IN PHOTOMETRY.

Prof. H. E. Clifford, of the Massachusetts Institute of Technology, delivered an address on "Some Fundamentals in Photometry." He urged the necessity of thoroughly calibrating the instruments and having due regard to the time element. He condemned the Lummer-Brodhun photometer, spoke well of the Kruss-Bunsen photometer, and said that the Jaly photometer gives results far too low. He recommended the Koenig spectro-photometer as a means for telling exactly whether a photometer is giving a true reading. He found that the Nernst lamp does not get down to its normal candle-power until a considerable time after current is turned on. Another point about the Nernst lamp is that it is particularly sensitive to change in voltage; a change of 5 volts on a 225-volt circuit for only a half a minute produces an effect such that the lamp does not recover its normal power for a period of 10 to 12 minutes after such fluctuation. He referred to an effect to be guarded against in the photometer as follows: If you have two lamps, one of a decided bluish tint and the other of a decided yellowish tint, and the two are compared, it will be found that the blue lamp has the advantage at greater distances from the photometer disk, and the yellow lamp the advantage at lesser distances, although they may be actually at mean distance of the same intensity. As a result it is necessary either to use a screen of the same color as the arc in arc light photometry, or else discard photometric measurements of the arc light as a means of rating. He recommended that arc lights should be rated by the illumination which they afforded.

In the discussion Prof. Mathews said that the Association Committee on Arc Light Photometry had taken into consideration in their measurements the color effect referred to by Prof. Clifford.

The only way to overcome the error due to that effect is to make the illumination of the disk quite low. Prof. Mathews said that during the year his committee had given attention to the Nernst lamp, the Welsbach mantel burner and the open gas flame. The watts per candle-power found for a single-glower Nernst lamp were 2.3; for a three-glower about the same, and 1.8 for a six-glower. The Nernst lamp has the advantage of an excellent quality of light, which is an important factor. In testing gas jets, the lights from a large number of tips were compared; though the different tips looked alike, the candle-power which they gave ran from 7 to 27 candles. In reply to a query, Prof. Clifford said that in the Nernst lamp, when the voltage is dropped by ten volts and held for one minute, and then restored to its normal value of 226 volts, the ratio of change in illumination was about 5.4 to 4.8, and the lamp does not return to its full voltage until after a period of about 10 minutes. In the case of a drop in voltage of 5 volts, the ratio became 5.1 to 2.7 and the lamp did not return to normal power for a period of 4½ minutes. Mr. N. W. Hanks said that if the pressure is dropped, the candle-power of the Nernst lamp will also drop; on raising the pressure again, the candle-power will not, of course, go up instantly to its full value, but for all practical purposes of general illumination this is a matter of little moment. Mr. Hanks said that Dr. Nernst has been using one of his glowers for standard work; the glower is operated free in the open air and brought into operation by means of an alcohol torch. The ballast is in series, and the candle-power is maintained constant by maintaining the current constant. The light he employed in photometry comes through a slit, which eliminates terminals. Mr. Arthur Williams said that in some tests with the osmium lamp, the voltage was increased from the normal voltage of 50 to 80 volts, with a corresponding increase of candle-power; after the voltage was restored to normal, however, the candle-power was only about 50 per cent. or normal, and it took some time for it to recover. Prof. Mathews said that in some tests the Nernst lamp, starting at 210 volts, ran to 230 volts, 220 being normal, with practically straight line relation. A change of 1 per cent. in the voltage made a change of 7 per cent. in candle-power. At 220 volts the candle-power was 27, and at 230 volts became 59. Much more uniform candle-power was obtained at constant current than at constant voltage.

Mr. Ryan said that when the Nernst lamp was first introduced the light was white, and it had a high efficiency but had a short life. The life has been improved, the efficiency has come down somewhat, and the color of the lamp to-day is nearly the same in quality as that of the incandescent lamp. Mr. Ryan considered that the open arc lamp with an opal globe gave a better light for the comparison of colors than the enclosed arc with a clear globe; a globe can, however, be selected for the enclosed lamp so that its light approximates to average daylight. The disadvantage of the open arc light in comparing colors, is the fatigue effect. Prof. Mathews suggested that matching colors should be done with the same light as that under which the colors will be used; for example, if a woman wishes to buy a dress to wear to a reception, she should choose the colors under light of the same character as will be used when she wears the dress. Prof. Jackson pointed out that, whereas arc lamps and incandescent lamps operated on low-frequency circuits give an unsatisfactory light, the Nernst lamp, on account of the large mass of its glowers, shows

very little variation in illumination at a frequency as low as 25 periods per second, and he thought that the Nernst lamp may be worked satisfactorily at a frequency as low as 17.5 periods.

REPORT OF THE COMMITTEE ON THEFT OF CURRENT.

Mr. Robert L. Elliott, chairman, presented the report of the Committee on Theft of Current. The paper enumerates the classes who attempt to defraud a company; the various methods adopted by such persons to divert electricity to their own use, and the means and measures to be taken by the company to discover the act and punish the offenders, and means for prevention. Quite a number of States have adopted laws on the theft of current, and after an examination of these the committee recommends that the following points should be covered in any new law:

First—Fraudulently making any connection with any electrical conductor so as to supply electricity without the consent of the company or without its passing through a meter set by the company.

Second—Fraudulently preventing any meter from duly registering, or altering its index, or interfering in any manner with its proper action or just registration.

Third—Fraudulently diverting electricity in any other manner whatsoever so as to use or waste it, without the consent of the company or without its passing through a meter set by the company.

Fourth—Any one aiding or abetting or counselling the above acts to be equally guilty with the principals.

Fifth—A penalty of a fine not exceeding $500, or imprisonment not exceeding one year, or both. (In many States the penalty is less.)

Sixth—Proof that any of the above acts were done on the premises of the accused, or that he received the benefit of such electricity, shall be *prima facie* evidence of his guilt. The last-named provision is that contained in the laws of two of the States, namely, Michigan and Montana. Such a provision as this should, if possible, be incorporated in all laws, as by putting, in some measure, the burden of proof on the accused person, it simplifies matters in court in cases where there is no direct evidence of the act of tapping the wire or tampering with the meter.

THEFT OF CURRENT.

Mr. T. H. Bartlett, of Philadelphia, said that his company, in order to prevent theft of current, encased the service wires and cut-outs and all wires between the service and house cut-out in an iron box. The box and meter are mounted on a light angle frame about 3 or 4 in. from the wall, and the meter itself is set immediately over the box in such a manner that the wires pass directly into the bottom of the meter, thence to the back of the box and up a conduit into the house conduit or switch. His company had had considerable trouble through the dial glasses of meters being removed and the dials turned backward. Mr. John L. Gilchrist said he had been informed that in England convictions for theft of current had been obtained under the old English common law. Mr. Elliott added that in Germany convictions have been secured on the grounds that theft of current is larceny.

ATTENDANCE.

Below is given a list of the central station men in attendance at the Chicago convention of the National Electric Light Association, so far as could be ascertained from the registers and from observation. Several did not register. All told, over 900 persons were in attendance. Elsewhere in exhibit notes will be found the names of the supply and manufacturing houses represented, and a very full roster of those present in their behalf.

Aberdeen, Miss.—Aberdeen Electric Light Plant, J. F. Enderlin.

Albert Lea, Minn.—Albert Lea Light & Power Company, B. J. Shockley.

Albion, N. Y.—Albion Power Company, J. H. Rollins.

Alliance, O.—Alliance Gas & Electric Company, D. W. Low.

Alton, Ill.—Illinois Power & Light Company, H. M. Bamer.

Altoona, Pa.—Edison Company, E. B. Greene, superintendent.

Ann Arbor, Mich.—Washtenaw Light & Power Company, W. H. Emphill, Jr.

Antigo, Wis.—Antigo Electric Light Plant, W. L. Elliott.

Atlanta, Ga.—Georgia Railway & Electric Company, G. W. Brine,

Attleboro, Mass.—Attleboro Steam & Electric Company, E. J. N. Eley.

Battle Creek, Mich.—Citizens' Electric Company, V. D. Simons, C. A. La Ferer.

Beatrice, Neb.—Beatrice Electric Company, E. F. Schurig, E. J. Sullivan.

Bellevue, Ill.—Bellevue Light & Power Company, C. M. Lewis.

Beloit, Wis.—Beloit Electric Company, J. S. Allen.

Big Rapids, Mich.—W. E. Donley Electric Light & Power Company, W. E. Donley, W. J. Trott.

Bloomfield, Iowa.—City of Bloomfield E. L. Dept., P. H. Palmer.

Bloomington, Ill.—B. N. Railway, Electric & Heat Company, C. F. Snyder.

Boston, Mass.—Brookline Gas Light Company, G. E. Crosby.

Boston, Mass.—Edison Company of Boston, C. L. Edgar, S. Hosmer, W. H. Atkins, L. L. Elden.

Brooklyn, N. Y.—Brooklyn Electric Light Company, L. W. Greene.

Brodhead, Wis.—Brodhead Electric Light Company, G. M. Pierce.

Brooklyn, N. Y.—Edison Electric Illuminating Company of Brooklyn, J. W. Lieb, Jr.

Carlisle, Pa.—The Carlisle Gas & Water Company, C. E. Ramsey.

Cedar Rapids, Iowa.—Cedar Rapids Electric Light & Power Company, W. J. Greene.

Cincinnati, O.—Cincinnati Gas & Electric Company, J. E. Winn, H. C. Hutchison.

Cleveland, O.—Water Works, E. W. Bemis.

Cleveland, O.—Cleveland Electric Illuminating Company, M. E. Turner, S. Scovil, S. C. D. Johns.

Colorado Springs, Colo.—Colorado Springs Electric Company, G. B. Tripp.

Columbus, O.—The Columbus Edison Company, A. W. Field.

County of Shawano, Wis.—C. D. German.

Chicago, Ill.—Sanitary Dist. of Chicago, A. S. Ceane.

Chicago, Ill.—Wadeford Electric Company, C. A. Lundberg.

Chicago, Ill.—Oregon Electric Power Company, J. H. Gammans.

Chester, Ill.—The Chester Light, Water & Ice Company, J. D. Gerlach.

Chicago, Ill.—Commonwealth Electric Company, J. J. Schafer, E. D. Alexander, W. H. Pierce, F. C. Hebard, E. E. Schermerhorn, J. E. Combiths, W. M. Anthony, J. M. Radford, R. E. Thurston, A. C. Hanna, R. Johnston, J. G. Barrett, S. C. Platt, W. A. Wells, C. J. Eaton, F. E. Eaker.

Chicago, Ill.—Chicago Edison Company, S. Insull, L. A. Ferguson, W. M. Anthony, F. Sargent, W. E. Carlton, J. M. Sadler, W. L. Abbott, R. F. Schuchardt, J. F. Gilchrist, W. H. Fairclough, Jr., J. P. Barrett, Jr., H. A. Seymour, W. C. Berry, J. W. Ferguson, H. M. Hope, R. L. Elliott, G. A. Freeman, J. H. Goehot, G. H. Jones, P. F. Williams, O. R. Hogue, H. B. Gear, W. H. Ott, C. G. Y. King, F. L. Richardson, O. J. Bushnell, P. Junkersfeld, A. Dunkee, E. Schildhauer, D. B. Bronson, H. Jampolis, R. Ferguson, C. E. Partridge, W. H. Collins, M. E. Terbush, W. M. Ness, H. F. Frosch, C. Schwartz, D. W. Roper, E. N. Lake, M. B. Joyce, B. K. Howard, G. N. Eastman, E. D. Edkins, B. G. Jamieson, S. O. Radtke, W. G. Kelley, B. D. Buell, A. G. Gerlach, C. Klusman, G. B. Springer, G. W. Conover, E. Lunn, J. B. Weidgmant, J. E. Tills, G. R. Miles, J. Thulin, L. I. Porter, C. A. Keller, S. M. Bushnell, G. E. McKana, D. H. Howard, W. F. Sims, J. T. Doody, R. Schmettge, C. H. Ibsen, J. F. McGlensey, A. B. Case, P. S. Biegler, W. E. Chadsibadhy, W. H. Fairclough, H. P. Rushing, Dr. J. D. McGowan, H. C. Patterson, T. Wilson, R. E. Strohm, S. Gardner, W. Holloway, A. D. Gilmore, J. O'Brien, L. D. Allen, P. L. Clarke, C. L. Davidson, I. E. Brooke, E. J. Switzer, H. L. Gannett, W. Leiderer, C. C. Parer, G. W. Barlow, P. H. Bate, R. Mueller, I. J. Walsh, H. O. Fife.

Dallas, Tex.—Dallas Ice Factory Light & Power Company, C. L. Wakefield.

De Kalb, Ill.—De Kalb Sycamore Electric Company, J. W. Glidden.

Delavan, Wis.—Delavan Light & Fuel Company, G. C. Gum.

Denver, Colo.—Denver Gas & Electric Company, H. L. Doherty.

Derby, Conn.—Derby Gas Company, R. E. Wyant.

Des Moines, Iowa.—D. M. Edison Light Company, J. W. Turner.

Detroit, Mich.—Detroit Edison Company, W. F. White.

Detroit, Mich.—Public Lighting Commission, A. S. Hatch.

Detroit, Mich.—Peninsular Electric Light Company, E. F. Phillips, Alex. Dow.

Edwardsville, Ill.—Edwardsville Electric Light & Power Company, C. A. Vallette.

Eldora, Iowa.—Eldora Electric Light Company, W. S. Porter.

Elizabeth, N. J.—United Electric Company of New Jersey, E. H. Stevens.

Elmira, N. Y.—Elmira Water, Light & Railroad Company, H. M. Bengler.

Evanston, Ill.—Evanston Heating Company, J. R. Kimball.

EVANSTON, ILL.—North Shore Electric Company, G. H. Lukes.

EVANSTON, ILL.—Calumet Lighting Company, F. W. Insull.

EVANSTON, ILL.—Evanston Electric Illuminating Company, H. E. Marshall, F. J. Baker.

EVANSVILLE, IND.—Evansville Gas & Electric Light Company, J. C. Gillette.

EUREKA SPRINGS, ARK.—Citizens' Electric Company, T. L. Hawley.

FALL RIVER, MASS.—Fall River Electric Light Company, H. Bottomley.

FREEPORT, ILL.—Freeport Railroad, Light & Power Company, A. E. Walden.

GALION, O.—City Electric Light Plant, H. C. Dye.

HARTFORD, CONN.—Hartford Electric Light Company, R. W. Rollins.

IOWA CITY, IOWA.—Iowa City Electric Light Company, G. S. Carson.

HOOPESTON, ILL.—Hoopeston Electric Light & Heating Company, C. J. Wakeman.

HOUGHTON, MICH.—Houghton County Electric Street Company, J. J. Frey, J. T. Kester.

JACKSONVILLE, ILL.—A. H. Kusler.

JACKSON, MICH.—Jackson Light & Power Company, F. Mench.

JAMESTOWN, N. Y.—Jamestown Light & Power Company, F. W. Bullock, superintendent.

JANESVILLE, WIS.—Janesville Electric Company, P. H. Korst.

JERSEY CITY, N. J.—United Electric Company of New Jersey, W. W. Titzell.

JOHNSTOWN, PA.—Johnstown Light, Heat & Power Compnay, A. Weis.

JOLIET, ILL.—Citizens' Light & Power Company, R. Roe.

JOPLIN, MO.—South West Missouri Light Company, G. M. Myers, W. Parsons.

JUNCTION CITY, KAN.—Kokomo Railway & Light Company, F. E. Tyler, T. C. McReynolds.

KALAMAZOO, MICH.—Kalamazoo Valley Electric Company, H. C. Hoagland.

KANSAS CITY, MO.—Kansas City Electric Light Company, M. G. Campbell.

KENDALLVILLE, IND.—City Electric Light Plant, F. E. Johnson.

KENOSHA, WIS.—Kenosha Gas & Electric Company, F. W. Bowen.

KNOX, IND.—Knox Lake Light & Power Company, M. O. Bish.

LA PORTE, IND.—La Porte Electric Company, J. H. Harding.

LAKE CHARLES, LA.—Lake Charles Ice, Light & Water Works Company, T. J. Bird.

LAMBERTVILLE, N. J.—Hunterdon Electric Company, W. S. Neuman.

LANCASTER, WIS.—Lancaster Electric Light Plant, G. P. Angus.

LEWISTON, PA.—Lewiston Electric Light Company, E. F. McCabe.

LEXINGTON, O.—New Lexington Electric & Power Company, O. J. Smith.

LIMA, O.—Lima Electric Railway & Light Company.

LINCOLN, NEB.—Lincoln Gas & Electric Company, J. S. Dales.

LONDON, ONT.—London Electric Company, C. B. Hunt.

LONG BRANCH, N. J.—Consolidated Gas Company of New Jersey, L. E. Kerns.

LOUISVILLE, KY.—Louisville Lighting Company, A. M. Worthington.

LYNCHBURG, VA.—Lynchburg Traction & Light Company, R. D. Apperson.

LYNCHBURG, VA.—Roanoke Railway & Electric Company, A. E. Anderson.

LYNN, MASS.—Lynn Gas & Electric Company, W. P. Hazeltine.

MADISON, WIS.—Madison Gas & Electric Company, C. H. Williams.

MARION, IND.—Marion Light & Heating Company, H. F. Reynolds.

MARLBORO, MASS.—Marlboro Electric Company, H. E. Ryder.

MARQUETTE, MICH.—Light & Power Company, C. Retallec.

MEMPHIS, TENN.—Memphis Consolidated Gas & Electric Company, F. G. Proutt.

MICHIGAN CITY, IND.—Lake Cities Electric Railway Company, A. A. Boyd, W. E. Wright.

MILWAUKEE, WIS.—N. W. Electrical Association, T. R. Mercein.

MOBILE, ALA.—Mobile Light & Railroad Company, J. H. Wilson.

MOLINE, ILL.—Peoples' Power Company, F. W. Reimers.

MONMOUTH, ILL.—Edison Illuminating Company, R. Ferris.

MONTPELIER, O.—Municipal Plant, L. H. Gilbert.

MONTREAL, CAN.—Lachine Rapids Hydraulic & Land Company, Limited, W. W. Walbank.

NEW ALBANY, IND.—United Gas & Electric Company, R. W. Waite.

NEW ORLEANS, LA.—New Orleans C. R. R. Light & Power Company; New Orleans Railway Company, L. H. Scherck.

NEW YORK CITY.—New York Edison Company, A. Williams.

NEW YORK, N. Y.—Dept. Water Supply, Gas & Electricity, F. E. Brown.

NEW YORK CITY.—The United Electric Light & Power Company, N. F. Brady.

NEWARK, N. J.—Public Service Company, J. J. Taffney.

NEWARK, N. J.—United Electric Corporation of New Jersey, A. H. Lynch.

NEWTON, MASS.—Newton & Watertown Gas Light Company, W. E. Holmes.

NIAGARA FALLS, N. Y.—Niagara Falls Electric Light & Power Company, J. E. Montague.

OAK PARK, ILL.—Cicero Light, Heat & Power Company, H. Almert.

OMAHA, NEB.—New Omaha T. H. Company, K. A. McLaughlin.

ONEIDA, N. Y.—Madison County Gas & Electric Company, C. W. Koiner.

PAWTUCKET, R. I.—Pawtucket Electric Company, O. Smith, Jr., J. A. Welch.

PEORIA, ILL.—Peoria Gas & Electric Company, R. S. Wallace.

PERU, ILL.—Municipal Plant, T. Weberling.

PHILADELPHIA, PA.—Philadelphia Electric Company, A. J. De Camp.

PHILADELPHIA, PA.—The Brush Electric Light Company, A. H. Manwaring, J. T. Hutchings, A. V. R. Coe, H. R. Kern, P. H. Bartlett, H. K. Mohr.

PITTSFIELD, MASS.—Pittsfield Electric Company, W. R. Gardener.

PLAINFIELD, N. J.—Plainfield Gas & Electric Light Company, W. A. McClurg.

PORT CLINTON, O.—Port Clinton Electric Light & Power Company, C. H. Bish.

PORT HURON, MICH.—D. J. Stephenson.

PORT HURON, MICH.—Port Huron Light & Power Company, J. A. Davidson.

PORT WASHINGTON, WIS.—The Wisconsin Chair Company, C. D. Leek, E. R. Kittredge.

PORTLAND, ORE.—O. R. G. Company, A. B. Frame.

PORTSMOUTH, O.—The Portsmouth Street Railroad & Light Company, J. H. Lange.

QUEBEC, CAN.—Quebec Jacques Cartier Electric Company, J. E. Tanguay, G. A. Montgomery.

QUINCY, ILL.—The Independent Light & Power Company, G. E. Mead, J. W. Cassidy.

RED OAK, ILL.—Red Oak Electric Company.—D. F. McGee.

RED WING, MINN.—Red Wing Gas & Electric Company, W. F. Putnam.

RHINELANDER, WIS.—Rhinelander Lighting Company, C. S. Wixson.

ROCHESTER, N. Y.—Rochester Gas & Electric Company, G. A. Redman.

ROCKFORD, ILL.—Rockford Edison Company, M. A. Beal, M. Heliger.

SAGINAW, MICH.—Bartlett Illuminating Company, A. G. Moser.

SAN ANTONIO, TEX.—San Antonio Gas & Electric Company, G. H. Cushman, H. H. Scott.

SANDUSKY, O.—The Sandusky Gas & Electric Company, A. C. Blinn.

SCHENECTADY, N. Y.—Schenectady Railway Company, E. Peck.

SIOUX CITY, IOWA.—Sioux City Gas & Electric Company, C. C. Gattland.

SOMERVILLE, MASS.—Somerville Electric Light Company, F. E. Smith.

SOUTH BEND, IND.—F. A. Bryan.

SPRINGFIELD, MO.—Gas & Electric Company, P. A. Bertrand.

SPRINGFIELD, ILL.—Springfield Electric Light & Power Company, A. V. Schroder, C. E. Hay.

ST. JOSEPH, MICH.—Benton Harbor & St. Joe Electric Railway & Light Company, W. W. Bean.

ST. LOUIS, MO.—The Laclede Power Company, E. V. Matlack.

ST. PAUL, MINN.—St. Paul Gas Light Company, H. J. Gille.

ST. PAUL, MINN.—Edison Electric Light & Power Company of St. Paul, A. P. Lathrop.

Streator, Ill.—Streator Gas & Light Company, A. K. Stiles.

Syracuse, N. Y.—Fulton Light, Heat & Power Company, G. W. Pilloce.

Taylorville, Ill.—Taylorville Electric Company, J. N. C. Shumway.

Terre Haute, Ind.—Terre Haute Electric Company, C. Mordock.

Tolono, Ill.—Tolono Light & Power Plant, A. L. Van Meter.

Topeka, Kan.—Edison Electric Illuminating Company, C. R. Maunsell, J. P. Griswold, A. H. Purdy.

Utica, N. Y.—Utica Gas & Electric Company, M. J. Brayton.

Vicksburg, Mass.—Vicksburg Railway & Light Company, F. H. Brooks.

Wabash, Ind.—The Wabash Electric Light Company, T. W. McNamee.

Warsaw, Ill.—Warsaw Electric Plant, E. B. Hillman.

Washington, D. C.—Potomac Electric Power Company, E. S. Barlow, H. W. Fuller.

Waterloo, Iowa.—Waterloo and Cedar Falls Gas & Electric Company, Austin Burt.

Watertown, Wis.—Watertown Electric Company, P. L. Utley.

Waupaca, Ill.—Waupaca Electric Light & Railway Company, I. P. Lord.

Wausau, Wis.—Wausau Electric Company, W. F. Collins.

Waxahachie, Tex.—Waxahachie Electric Light Company, J. F. Strickland.

West Chester, Pa.—Edison Electric Illuminating Company, J. E. Pyle.

Winona, Minn.—Winona Railway & Light Company, S. B. Livermore.

Woburn, Mass.—Woburn Light, Heat & Power Company, J. W. Cowles.

Worcester, Mass.—Worcester Electric Light Company, H. H. Fairbanks.

York, Pa.—Edison Electric Light Company, J. F. Dinsman.

Youngstown, O.—The Youngstown Consolidated Gas & Electric Company, S. C. Rogers.

CONVENTION NOTES.

PREST. C. L. EDGAR.

Mr. Charles L. Edgar, the new president of the National Electric Light Association, while still a young man, is one of the oldest and most experienced central station managers in the country. He was born near Princeton, N. J., in 1860, and graduated in 1882 from Rutgers College, where he afterwards took a post-graduate course in electricity. He received the degree of A. M. in 1885 and of E. E. in 1887. Shortly after leaving college he joined the Edison ranks, and by sheer merit soon became chief engineer of the old parent Edison company. He was then put in charge of the young system of the Edison Electric Illuminating Company of Boston, of whose remarkable growth a most interesting illustrated account was given in Electrical World and Engineer last year by Mr. E. W. Mansfield. The company to-day, under Mr. Edgar's able and vigorous presidency, is doing a business of over $3,000,000 a year, and it is now building another new station of 60,000-kw capacity in turbo-generators of the Curtis type. Meantime, under the Edgar regimé, the Boston Edison Company has acquired the big Brush system of Boston, and now it has also gathered under its wing a whole network of environing suburban electric light and power companies. The Boston development is one of the most interesting chapters in the earlier history of electric current generation and distribution in America.

Mr. Edison has long been an active member of the American Institute of Electrical Engineers and is now chairman of the successful Boston chapter. He has thrice been president of the Association of Edison Illuminating Companies, and is now president of the Massachusetts Electric Lighting Association. As far back as 1890 he was a vice-president of the National Electric Light Association, being in fact one of the very first men who had the foresight and fellowship that closed up the ugly gap between the arc lighting and incandescent lighting interests among local companies. Mr. Edgar is, indeed, a man who can work easily with others as leader or comrade, and many instances could be cited of his endeavors in taking up and pushing to success innovations in the art. He is also a charming companion with social instincts as strongly marked as his technical ability, and is a member not only of the University and Lawyers' Clubs of New York, but of the University, Art and Exchange Clubs, of Boston. He has a wife and one son of 15. The Association is to be congratulated on the willingness of such men to serve it.

The Photographic Group taken as usual cannot be said to be a great success as a comprehensive picture of those present. Possibly 200 to 250 were persuaded to go from the hotel down to the Art Institute, on whose steps it was taken. But as over 900 people attended the convention, it will be seen that the vast majority were "not in the picture."

The Convention Hall, known as the banquet room of the Auditorium, was in some respects well fitted for the purpose, but it was so remarkably crowded all the time, many delegates could not stand the heat. As for ventilation there was none. But after awhile some fan motors were introduced and conditions became bearable. The number of those in session each day was, if anything, a larger percentage of those present than at Cincinnati last year.

Visiting Fisk Street Station.—On Wednesday afternoon following the Robb paper on steam turbines, some 300 members went en masse to the new Fisk Street station of the Chicago Edison and Commonwealth Companies, headed by President Insull and Vice-President Ferguson, where, as already noted in these pages, bold engineering work of a sensational character is being done in the equipment of the largest steam turbine generating plant in the world. The party took trolley cars to the Van Buren Street bridge on the south branch of the Chicago River, and there boarded craft which carried them down the river to the imposing and handsome station now nearing completion and already a conspicuous landmark. On arrival the party broke up into squads of twenty each under a guide and every corner of the works was inspected. A group photograph was taken, and on the return trip a portion of the party was taken out to the lake and then landed at the Chicago Yacht Club. The Commonwealth Company owns and keeps in commission an electric launch for regular river service between the city offices, the Harrison Street station and Fisk Street station, and this was also availed of by many visitors during the morning hours of the week.

Mr. C. O. Baker, Jr., who always takes his duties as master of transportation very seriously, was greatly gratified at being able to put his special New York Central and Michigan Central train into Chicago more than an hour ahead of time. He and the party received many congratulations of the speedy trip and on the general excellence and comfort of the service. Mr. Baker is rather inclined to the belief that in these days of big overgrown conventions, the time for "specials" where everybody knows everybody, and it is all one jolly party, has gone by; but he may be persuaded to get up for the old-timers at least a car to St. Louis next year. It was there some years ago that in recognition of valuable services already rendered, the members of the Association presented Mr. Baker with a handsome loving cup.

Mr. Ernest H. Davis, second vice-president, in the unfortunate absence of Mr. J. B. Cahoon, from sickness, made an excellent secretary, and Mr. Cahoon's resignation being received, Mr. Davis was elected as honorary secretary and treasurer for the ensuing year. It is needless to say that the work of Miss Harriet Billings, the assistant secretary, was efficiency itself. Miss Douglas also rendered valuable help, as well as Mr. Freeman, from the forces of the Chicago Edison Company. Supplying over 800 people with documents and information and getting them registered, is no mean feat, when added to the work of a busy convention sitting twice daily.

The Question Box instituted last year by President Doherty was an even greater success this year. Mr. H. T. Hartman, who had been appointed editor, made a great success of his labor of love, and turned out a separate pamphlet in excellent style, embracing just 200 pages, with a careful index. All the matter was carefully and intelligently edited, and the bulk of it is very interesting data from men well posted on the details of the industry. Bulky as it is, the pamphlet does not include all the material offered, as some of the best stuff came in at too late a moment to be included.

LADIES AT THE CONVENTION this year were strangely few and far between, from out of town, but the hospitality extended was none the less cordial and generous. There were tally-ho rides, receptions, theatre parties and other amusements to wile away the week, and occupy the hours when husband, brothers and other relatives were discussing Ohm's law in all its practical aspects and bearings. The Pompeian Court in the Annex became the general gathering place in the evening, where many ladies could be seen in handsome costumes.

New York Electrical Society.

The New York Electrical Society will hold its annual meeting for the election of officers at the Café Boulevard, Tenth Street and Second Avenue, New York, Wednesday, June 10, at 9 P. M. At 7 o'clock a dinner will be served for the members and their friends.

A special meeting of the Society was held on the evening of June 1 for the consideration and discussion of the amendments to the Constitution and By-Laws reported by the executive committee to the 234th meeting of the Society April 29. The meeting resolved that the amendments of the Executive Committee be adopted, with the exception of two clauses, bearing respectively on the eligibility of the president for a second immediate term, and the method of electing the officers of the society. In lieu of the first of these clauses, a motion was adopted that no officer except the secretary and the treasurer should be eligible for immediate re-election. As a substitute for the second clause it was resolved that the election of officers should be by ballot, and the method to be adopted should be substantially that now used by the American Institute of Electrical Engineers.

The attendance at the meeting could hardly be considered as representative, being only 15 out of a membership of over 600. A portion of the membership is strongly in favor of leaving the nomination of officers in the hands of a nominating committee.

Canadian Electrical Association.

The Canadian Electrical Association will hold its thirteenth annual convention at the King Edward Hotel, Toronto, June 10, 11 and 12. Papers will be read as follows:

Wednesday, June 10.—"Long-Distance Transmission," by Mr. Paul Lincoln, Pittsburg, Pa. Question Box.

Thursday, June 11 (10 A. M.).—"Individual Electric Drive and its Relation to the New Shop Methods," by Mr. R. T. Lozier, Cincinnati, Ohio; "Some Points Relating to Submarine Power Cables," by Mr. G. U. G. Holman, Quebec. 2 P. M.—"Single-Phase Alternating Motors as a Means of Increasing Station Earnings," by Mr. W. A. Layman, St. Louis, Mo.; "Transformers for High-Voltage Transmission Lines," by Mr. J. W. Farley. Question Box.

On Friday, June 12, the election of officers will be held.

Social Features.—Wednesday, June 10, 4 P. M., tally-ho drive to points of interest in the city by courtesy of Canadian General Electric Company; 8 P. M., excursion by special steamer and band concert at Toronto Island. Thursday, June 11, 4 P. M., visit by special cars to the works of the Canada Foundry Company, by courtesy of the company; 9 P. M., annual Association dinner, King Edward Hotel.

Cheap Food at Last.

The *London Lancet,* a medical publication, announce recently that some day the world's food supply may be furnished by electricity. By passing a current through soda water or water impregnated with carbonic acid gas, a series of products is formed culminating in sugars. But the food-value is dependent on the building up of proteid in the same way; and there lies the doubt. "Carbonic acid gas and water are abundant enough through the whole world," says the *Lancet,* "and to convert these simple substances into complex foodstuffs, for the supply of which we have to look to far countries, by simply manipulating them with the electric current, surely promises to bring about one of the greatest revolutions in the history of the world." We don't see any trouble at all about the "simple manipulation." All that is necessary is to do it.

CURRENT NEWS AND NOTES.

CABLE TO MANILA.—A cable dispatch from Manila of June 2 says: "The British cable steamer *Anglia,* engaged in laying the Commercial Pacific cable, arrived at Guam at midnight. She had good weather throughout and her trip from this port was entirely successful. It is expected that the Guam end of the cable will be spliced to-day, completing connection between Manila and Guam."

PHILADELPHIA MEETING A. I. E. E.—The last meeting for the season of the Philadelphia branch of the American Institute of Electrical Engineers will be held on Monday evening, June 8, at 8 o'clock, at Drexel Institute, Thirty-second and Chestnut Streets. Mr. Joseph Menchen, of New York, designer of electrical theatrical effects, will show how electricity is made use of on the stage, and will illustrate with actual apparatus and scenery, how such effects as waterfalls, sand storms, moving clouds, water ripples, rainbows, etc., etc., are produced upon the stage. Mr. W. L. Hodges expects to show experimentally the speaking arc. There will be an informal dinner at Boothby's, Chestnut Street, below Thirteenth, which all members are invited to attend.

INSTITUTE NIAGARA MEETING.—To judge from the interest that is being shown and the work being done at Chicago, the July meeting of the A. I. E. E. at Niagara Falls will be the most successful one in the history of the body. It it safe to say that Chicago and the middle west will be well represented, and will send not only a large delegation, but also the newly-elected president of the Institute, Bion J. Arnold. A most energetic campaign is to be made by a committee appointed by the local secretary, P. Junkersfeld. This consists of Homer E. Niesz, chairman; Trueman B. Gaylord and V. R. Lansingh. These gentlemen will also have charge of the transportation.

TESLA'S WORK.—The *New York Sun* has the following editorial note: "It is now a little more than two years since the *Sun* gave to the world Mr. Tesla's announcement that, some time within the eight months following, he would send a wireless telegram across the Atlantic Ocean. With the failure of that prediction the public is familiar, although not with the immediate cause. As we understand it, progress toward fulfilment revealed possibilities so much greater that it was determined to aim at a higher mark, and we are now authorized to say in Mr. Tesla's behalf that some time within the present year he will send wireless telegrams to the other side of the world. The Tesla oscillator is to deliver to the earth the shock that will be felt and recorded on its uttermost confines. As before, we have to wait and see, doubtful because of the miraculous character of the task, but hopeful on the strength of the wonders that science has already done."

WIRELESS TELEGRAPHY ON THE LAKES.—Special telegrams from Chicago state that the wireless stations at Chicago and Milwaukee exchanged their first dispatches on June 1. Mayors Harrison and Rose complimented each other, and several other persons exchanged greetings. At the Chicago station only four persons were present. They were Henry W. Beauclerc, Chicago representative of the Marconi Company; W. W. Bradfield, Marconi's chief assistant; H. J. Round, another of Marconi's engineering staff, and H. J. Moffitt. In Milwaukee the party which attended the opening consisted of Mayor Rose, F. G. Bigelow, president of the First National Bank of Milwaukee; John I. Beggs, president of the Milwaukee Electric Railway & Light Company; E. C. Lewis, of New York City, a director of the Marconi Company, and C. H. Taylor, who is in charge of the Milwaukee station. The two stations on Lake Michigan have been erected by the Marconi Company and will be used for the transmission of ordinary paid messages. Negotiations are now on with a board of trade concern for the transmission of market and stock quotations. A station will be built at South Haven within a short time, and the system will be gradually expanded until every port on the great lakes has a station. This is the plan of the Marconi Company. It is also intended to instal Marconi instruments on some of the larger lake vessels.

PREVENTION OF HUNTING.—A patent was granted on May 12 to Mr. Hermann F. T. Erben, of Schenectady, N. Y., for means to prevent hunting of synchronous alternating-current machinery. This means consists in the use of conductors looped or short-circuited about the pole-tips, together with bridging conductors extending between short-circuited conductors about adjacent pole-tips. In case of hunting, the flux through the pole corners varies periodically, and this variation is strongly opposed by the currents induced in the above system of conductors. This reaction imposes a strong restraint upon any tendency to hunt which the machine may have, in a manner similar to the action of previous devices, designed for the same purpose.

POSTAL TELEGRAPH PENSIONS.—The Postal Telegraph Cable Company announces in a circular distributed broadcast over its system that it will pension all employees who have become incapacitated after having served the company continuously for fifteen years. After fifteen years such operator may draw 20 per cent. of his salary when he leaves the service. Every year thereafter an additional 3 per cent. is added to this until the beneficiary receives half of the salary he received when at his best. The pension plan becomes operative at once. It was the earnest desire of John W. Mackay, late president of the Postal Company, that some provisions be made for the benefit of faithful employees who had grown old in the service and whose usefulness had been impaired by age or misfortune.

SYNCHRONIZING APPARATUS FOR ALTERNATORS.—A patent was granted on May 12 to Mr. Fred T. Dow for a simple arrangement for connecting alternators in parallel. There is one common synchronizing circuit for all the machines of the station, which contains any desirable phase indicator, such as an incandescent lamp or a voltmeter, or both. This synchronizing circuit is normally closed, but the e.m.f. of any pair of alternators in the station may be impressed upon it. For this purpose each alternator is connected with the primary of a step-down transformer, and the secondary of each transformer may be inserted into the synchronizing circuit by simply putting a plug into a socket. When several machines are operating and another one is to be connected in parallel with them, the secondaries of one of the former and of the new machine are inserted in series into the phase-indicator circuit, and when the lamps indicate maximum potential and the voltmeter needle attains a condition of minimum vibration, the new machine is connected to the distributing circuit.

POWER FACTOR METER.—A patent was granted on May 26 to Mr. Otto Holz for various forms of a power factor meter for use in polyphase circuits, all forms being based on the principle that in an equally loaded polyphase system the ratio of the readings of two wattmeters, connected with different phases, is a function of the power factor. In each type of instrument, there is a fixed and a movable member, the latter being acted upon by two opposing torques, which represent the two wattmeter readings mentioned. The movable coil assumes a position in which the two torques balance each other and this position thus becomes a function of the power factor. The first type described contains two fixed current windings and two voltage windings, which are mounted on one movable shaft. Each current coil and its corresponding voltage coil constitute a wattmeter and the connections are so made that one potential coil tends to turn in a direction opposite from the other. In a three-phase system, for instance, the two current coils may be inserted in fuse 1 and 3 and the two voltage coils are connected between phase 1 and 2, and between phase 2 and 3 respectively. This type of instrument may be simplified by using only one fixed current coil and two movable voltage coils, or by using two fixed current coils and a single movable potential coil. Other types of this instrument operate by electrostatic instead of electrodynamic action, although the fundamental principle is the same.

WIRELESS TELEGRAPHY.—A patent was granted on May 26 to Mr. James Foster King on a form of receiving apparatus for wireless telegraphy which differs in several details from previous forms. While in ordinary practice the receiver-relay is operated in the receiving circuit direct, in the present case it is actuated from a secondary or induced circuit. The coherer is a glass-sealed tube in which are carried two silver plates with flat upper surfaces, separated longitudinally by insulation; of these plates the one is earthed and the other connected with the vertical wire. On these plates are placed the coherer particles which have a magnetic core of iron, surrounded by a very thin, well conducting, but non-magnetic and non-oxidizable covering of platinum; the purpose is to prevent the destructive action of sparks and to produce a better contact between the particles, so that more current flows through the coherer than would otherwise be the case. Oxidation of the particles is further prevented by exhausting the air from the tube. The top of the coherer tube is secured to a magnet pole piece connected to the iron core of an induction coil. The primary of this induction coil is connected in series with the coherer plates, the coherer battery, a choking coil and a part of the aerial circuit. The secondary of the induction coil contains the receiving relay. When a wave arrives the particles cohere and the battery sends a current through the primary of the induction coil. This has a double effect: it induces a current in the secondary connected to the relay and at the same time energizes the magnet pole piece, which raises the coherer particles from the plates and causes them to decohere.

ELECTROLYTIC ARC LIGHT.—A patent was granted on May 19 to Mr. William J. Dean, of Chicago, assignor to the General Electric Company, for an electric arc lamp in which the principle of the Nernst lamp is employed in so far as the final arc is formed between two cores of some refractory oxide, such as zirconium or magnesium, which have a high resistance when cold, but become conductors when heated to incandescence, and remains incandescent with little loss of material. The difficulty of such an electrolytic arc lamp lies, of course, in the starting of the arc and the method of overcoming this difficulty is the essential point of Mr. Dean's invention. Both electrodes are in tubular form, with an inner core of the refractory electrolytic conductor, and an outer shell of carbon. The two electrodes are placed vertically one above the other, and the electrolytic core of the upper electrode is loose in its carbon shell. When no current is flowing, the end of the upper electrode rests upon the lower one, the two cores and the two shells being in contact. On closing the circuit, current passes through the two carbon shells, and by an electromagnetic clutch device the upper shell is raised and strikes an arc between it and the lower shell. This arc heats the two electrolytic cores until their resistance becomes less than that of the carbons; the current then passes mainly through the inner cores and, by the action of the increased current upon the electromagnetic clutch mechanism, the upper shell is further raised. In rising, it strikes a nose provided at the upper end of the core and thus takes this core upwards. The arc is then found between the two electrolytic cores.

POWER FACTOR REGULATOR.—A patent granted May 5 to T. J. Johnston describes a means whereby an alternating-current circuit may be automatically and continuously compensated for varying differences of phase between the e.m.f. and current flowing, due to inductive devices in the circuit. Advantage is taken of the property of the synchronous motor whereby through change of field excitation it may be caused to give either a leading or lagging current. On the shaft of a synchronous motor is mounted the armature of the motor exciter, this armature being connected by a pair of slip rings and brushes to the secondary of a transformer, the primary of which is in series with one leg of the circuit to be compensated. The field current for the synchronous motor is taken from a commutator on the exciter armature, there being a regulating rheostat in the field circuit. The polar points of the exciter armature should be so disposed that the maximum magnetization due to the wave of the main alternating current will be of opposite sign to the magnetization of the field poles and somewhat ahead of that due to the rotation of the armature across the poles. Under this condition if the current in the main circuit leads the e.m.f. the resultant magnetization due to the alternating current and the exciter field will be cut down, and the current in the field of the synchronous motor will diminish, lowering its magnetization. The synchronous motor thus becomes under-excited and furnishes an inductive reactance to the system which neutralizes the leading current. On the other hand, if the current lags the resultant magnetization of the exciter armature is such, inasmuch as the magnetic maxima due to the alternating current and to the exciter field come more in line, as to increase the potential and current of the exciter, thus raising the effective field magnetization of the motor and furnishing a capacity reactance which neutralizes the lagging current.

LETTERS TO THE EDITORS.

The Use of Differentially Wound Telephone Receiver in Electrical Measurements.

To the Editors of Electrical World and Engineer:

SIRS:—After I had forwarded you an article on the use of differential telephone receiver in electrical measurements, I found that the additional resistances, *r r*, in Fig. 1 for the comparison of capacities were superfluous. The necessary and sufficient condition is that the capacity reactances of the capacities to be compared are very large with respect to the resistance and the inductance of the receiver coils and *R*.

TOKYO, JAPAN. H. HO.

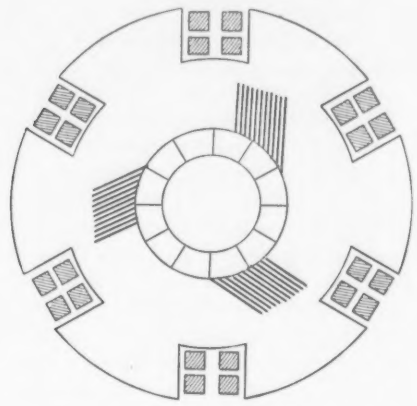
[The article by Prof. Ho appeared in our issue of May 23.—EDS.]

Commutation of Alternators.

To the Editors of Electrical World and Engineer:

SIRS:—I believe it would interest your readers to know that the commutation of alternators of my design, in which I make use of the ordinary winding of the continuous-current armatures is as good with few bars on the commutator as with many. With a drum winding consisting of twelve coils divided into six slots per complete magnetic circuit (accompanying sketch), the commutation is perfect. The damping of harmonics is produced automatically not only by the short-circuiting of the rotor through the exciting circuit, as before indicated by myself in these columns (April 5, 1902, p. 606), but also by the short-circuiting of the rotor coils through the brushes.

These two ways of damping of harmonics which I have personally



COMMUTATION OF ALTERNATORS.

discovered are more than sufficient to suppress every harmonic and to give a perfect commutation. Instead of placing the coils in one slot only it is possible to put them in several slots per pole, as proposed by Mr. Fischer-Hinnen for continuous-current dynamos.

PARIS, FRANCE. M. LATOUR.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Non-Synchronous Alternating-Current Generators.—FEIDMANN.—An abstract of a paper read before the Cologne Electrical Society on non-synchronous alternating-current generators. After some general notes on the reversibility of induction motors for the purpose of using them as generators, he discussed the prospects of the new compensated Heyland machines in practice. They may be connected in parallel in the same simple way as direct-current dynamos, without regard for synchronism; if the non-synchronous dynamo is running too slowly when connected in parallel with another, it simply takes current as a motor; if it is running too quickly, it gives off to the network the power corresponding to its speed. Another similarity with direct-current, shunt dynamos is that they give more or less power according to their higher or lower speed. But this is the case only within certain speed limits; this fact gives new points of view for the construction of the steam engine regulators. Another new property is the possibility of using these machines in series. If, besides the shunt excitation, the main current is also led into the Heyland commutator, the machine may be absolutely compounded. Such compound generators have been bulit for trial by Brown, Boveri & Co. (100 hp), and some smaller ones by Schuckert, Lahmeyer, Siemens & Halske, and the General Electric Company, of Berlin. They may also be used instead of the synchronous machine required in the central station to set the step. The operation of such a station would be relatively simple, especially if the larger motors connected to the network were compensated for unity power factor, so that they take no wattless currents from the line. Of course, prophecy does not prove anything, but it seems as though this new type of dynamo may soon be of considerable importance in practice.—*Elek. Zeit.*, May 14.

Three-Phase Generator with Small Voltage Drop.—KEHSE.—A communication referring to a recent description by Heyland of a three-phase generator with small voltage drop, which in this case was due to high saturation of the pole cores. In order to reduce the voltage drop of a machine, it is necessary to have the counter-ampere windings and the stray field e.m.f. small; this can of course be done by designing machines of large dimensions, but they are expensive. Another method is the use of highly saturated teeth and the use of several (three to five) slots per pole and phase. He thinks the saturations of 20,000 to 24,000, as used in direct-current machines, may also be applied to alternators. While the loss per unit of volume is larger, the heat may be easily removed by air canals. The heat in the teeth is due to rotating hysteresis; as found by recent investigation, the losses at an induction of 20,000 are not much greater than at 16,000. He gives a numerical example showing the calculation of the losses.—*Elek. Zeit.*, May 7.

REFERENCES.

Compensated Alternators.—BRAGSTAD.—The first part of an article illustrated by diagrams, being a contribution to the theory of polyphase commutator motors with shunt excitation. The theories which so far have been published on such machines can be considered only as a first approximation, because the influence of stray fields, of ohmic losses and of the slip, are neglected. The author takes these factors into account, but does not consider what happens in the commutator, and in the coils which are short-circuited by the brushes. He first investigated what takes place when a direct-current winding revolves in a rotating field and discusses the ratio of the e.m.f's and currents in the stator and the rotor.—*Elek. Zeit.*, May 14.

Alternators in Parallel.—GEORGES.—A communication on the surging of alternating-current machines connected in parallel. He replies at length to some recent critical remarks of Benischke.—*Elek. Zeit.*, May 14.

Output of Traction Motors.—BARBILLION.—A brief mathematical article, illustrated by diagrams, on a simple practical method for determining the characteristic curves of a traction motor at various loads, if its characteristic curves are given for one special case. A series motor with resistance inserted in the armature for speed regulation, is considered; the curves of the speed, output and traction effort as functions of the current are assumed to be given for no resistance in the armature. He describes methods for determining therefrom the corresponding curves of the speed and output, when resistances are inserted in the armature.—*L'Eclairage Elec.*, May 16.

Converters.—VERHOECKX.—A mathematical article illustrated by diagrams in which he gives a general analysis of the currents in the armature of converters or double-current generators.—*L'Eclairage Elec.*, May 16.

Lights and Lighting.

Electric Lighting of the Aldershot Camps.—An illustrated description of a very large private lighting installation, with steam turbines for power generation. There are three turbines, running at 2,000 to 2,200 r.p.m., and directly coupled to 250-kw, shunt-wound, direct-current generators giving current at 400 to 450 volts. Regulation is accomplished by means of an electric governor consisting of a solenoid and a plunger acting against the pull of a certain spring. Each turbine is also fitted with a centrifugal governor. There is also one 100-kw turbo-generator with two dynamos mounted in tandem on the shaft, which may be used as a steam balancer when desired. For boosting and balancing, four machines are mounted on one shaft, and comprise two compound-wound machines for balancing, capable of dealing with 100 amp. out of balance, and driving two generators, each capable of raising the pressure 100 volts when 250 amp. is passing through them. There is a battery of 230 cells with a capacity of 100 amp. for 10 hours and 21 regulating cells at each outer end. There are about 16,000 lamps of 8 cp employed in internal lighting and 100 hp for motors for various purposes.—Lond. *Elec.*, May. 15.

Mercury Vapor Arc.—Stark.—An illustrated description of some experiments with the mercury vapor arc. If such an arc is passed through a vacuum tube which communicates with another vessel not in the direction of the discharge, then there is a higher vapor tension of the mercury vapor in the discharge tube than in the vessel with which the tube is connected; some of the mercury vapor is, therefore, driven into this vessel and can be observed there because it is still incandescent. He also made experiments on the behavior of these mercury vapor rays in a magnetic field.—*Phys. Zeit.*, May 1.

REFERENCE.

Electric Lighting of Railway Cars.—Goetze.—Continuations of his illustrated article on the various systems used for the electric lighting of railway cars.—*Centralbl. f. Accum.*, April 1, 15, May 1.

Power.

California Petroleum as a Fuel.—Hunt.—An illustrated article on California petroleum and its use as fuel. The low price of crude oil during the past two years has entirely changed the fuel situation on the Pacific coast. It has very materially reduced the cost of steam power and has made it possible in many locations and under certain conditions of load factor to compete with transmitted power from hydro-electric stations. While the transmission of power has its own field when it will always control the situation, it is a broad contention that given the conditions of load such as exist in San Francisco to-day in the best equipped central stations, and with oil at prices at which long-term contracts have been made, steam generated power can more than hold its own.—*Jour. of Elec.*, May. The same issue contains an article on petroleum from a chemist's standpoint by O'Neill, and a very long and profusely-illustrated article bv Bates on the application of crude oil to gas engines.—*Jour. of Elec.*, May.

REFERENCES.

Electric Driving in the Machine Shops.—The first part of an article giving some notes on two recent papers read before the British Inst. Elec. Eng. One, by Shatwood, dealt with three examples of electric driving in small machine shops; the other, by Williamson, is a description of the driving arrangements at the works of Vickers Sons & Maxim. The notes so far given do not seem to contain anything new.—Lond. *Elec. Rev.*, May 15.

Water Power Development.—Judge.—The first parts of a serial on the legislative questions involved in water power developments.—*L'Eclairage Elec.*, May 2, 9, 16.

Traction.

Electrolytic Action of Stray Currents from Tramways.—A reprint of the rules proposed by a special committee of the German Association of Electrical Engineers concerning the protection of metallic pipes against earth currents from electric tramways. The conditions of danger and the zone of danger are defined. To diminish these earth currents the following rules are given. With tramways using the two-wire system—if there is not a regular reversion of polarity, at least once a day—the rails are to be connected with the negative pole. If the voltage drop in the connecting wire is above 2 volts, this wire must be insulated. The rail joints must be of such a nature that the resistance of the rails is increased by the joints by not more than 0.03 ohm per km for a single track; besides this, the two rails of a track are provided with a cross connection at every tenth joint. For a double track there is a cross connection of the two tracks at every twentieth joint. The feeding points of the rails should be placed at as great a distance from the pipes as possible. Under no circumstances should the rails be connected with the pipes. For diminishing the voltage drop in the rails, return cables and sucking dynamos (negative boosters) may be used. The junctions of the water and gas pipes should be made of insulating material.—*Elek. Zeit.*, May 14.

Trolley and Conduit Systems.—An abstract of the chief engineer's report to the London County Council on the relative costs and advantages of the overhead trolley system and the underground conduit system. Some statistical data and estimates are first given on the cost of both systems and their relative advantages are discussed. The difficulties of construction in the conduit system are enumerated. Concerning durability and maintenance, the comparison is in favor of the conduit system by reason of the greater weight and rigidity, and the substantial method of support of the conductor tees as compared with the flexible overhead wires. In summing up the total costs, the following figures are given for the conduit system: Conduit construction, rails, roadwork, etc., $70,205; power station, cables, sub-stations, cars, etc., $61,300; total, $131,505. For the trolley system: Rails, roadwork, overhead line, etc., $37,480; power station, etc., $61,300; total, $98,780, or 33.13 per cent. more for the conduit system than for the trolley system.—Lond. *Elec.*, May 15.

REFERENCE.

Surface-Contact System.—Loewy.—The first part of an illustrated paper read before the Vienna Electrical Society on surface-contact systems for electric tramways and especially on the system of Hillischer.—*Zeit. f. Elek.*, May 17.

Installations, Systems and Appliances.

Protection Against Atmospheric Discharges.—A report of a special committee of the German Association of Electrical Engineers on the protection of electric high-tension installations against atmospheric discharges. The committee had sent out letters of inquiry to 1,000 stations in Germany and received replies from 170. A great variety of different systems of lightning arresters is used, but as with all of them there have been accidents, it seems that there is no absolutely sure protection against atmospheric discharges. The opinion is, however, expressed that for high-tension installations horn lightning arresters have given the best results, and for low-tension installations, those with magnetic and with "automatic" extinction of the spark were the best. With horn lightning arresters in free air, short-circuits may be caused by rain or snow, when the spark-gap is short; but there are no bad effects, as the arc produced is at once extinguished as though it was caused by an atmospheric discharge. Of course, there is a considerable voltage drop in the network; to avoid this the lightning arrester should be placed under a roof which is preferred to using a long spark-gap. The lightning arresters should be examined from time to time. The fact that atmospheric discharges occurred at times when there was no thunderstorm, is confirmed repeatedly. In some installations the earthing is done by connections to water pipes, but the committee thinks this is not advisable, because if there are simultaneous discharges on lightning arresters of different poles, then the line is short-circuited by means of the arcs through the water pipes. Some notes are given on the earthing of machines or transformers. Among the plants—in which there have been no disturbances—there was a greater percentage in which the frames of the machines were especially earthed, than of those in which they were specially insulated. Nvertheless it would be wrong to conclude that the earthing of the iron frame is a means of avoiding disturbances due to atmospheric discharges, because the action of the lightning arresters must be taken into account and because the number of those plants in which the frames are either specially earthed or specially insulated, is too small to draw safe conclusions.—*Elek. Zeit.*, May 7.

Use of Meters.—An abstract of the report of a committee, appointed by the Professional Syndicate of Electric Stations, on the use of meters in the systems of French central stations. The report gives a summary of the replies received to inquiries sent to the different central stations. For direct current, motor meters are universally used. The meters are tested at different intervals by the

different stations, these intervals varying between one month and two years; in some stations they are tested only upon a complaint of a customer. The replies received concerning starting and exactness were rather uniform; they indicate that a meter starts at about one-fiftieth of its normal power and that the accuracy is about one-twentieth of this power. The use of the O. K. (O'Keenan) meter is less general than that of the Thomson meter; but the former seems to be considered to be more sensitive. Concerning alternating-current meters, less replies were received. The following types are in use: Batault, Blathy, Japy, and that of the Creil Co. The meters are said to register the wattless current at a power factor above 0.6 to 0.8; some are said to be exact for a power factor of 0.3. They are practically independent of the variations of e.m.f., and of the wave form. Nothing is said on the influence of the frequency.—*L'Ind. Elec.*, April 25.

REFERENCE.

Switchboards.—BENISCHKE.—An illustrated paper read before the Vienna Electrical Society on the design and installation of switchboards for high-tension plants.—*Zeit. f. Elek.*, May 15.

WIRES, WIRING AND CONDUITS.

Standardization of Conductors and Cables.—Sets of standardization rules for electric conductors and cables of various types, as proposed by a special committee of the German Association of Electrical Engineers. In the rules for copper conductors, the specific resistance of copper is defined as the resistance in ohms of 1 meter length and 1 sq. mm cross-section at 15° C. The conductivity is the reciprocal value of this resistance. Copper, the specific resistance of which is greater than 0.0175, or the conductivity of which is smaller than 57, should not be accepted for conductors. Copper of the conductivity 60 is to be considered as standard copper of 100 per cent. conductivity. The temperature coefficient per degree C. is assumed to be 0.4 per cent.—*Elek. Zeit.*, May 7.

ELECTRO-PHYSICS AND MAGNETISM.

Dynamics of the Electric Field.—J. J. THOMSON.—A paper in which he investigates some of the consequences of the distribution of mechanical momentum in the electromagnetic field, occasioned by the presence of electric displacement and magnetic induction. He arrives at the view that the lines of electric force carry along with them a portion of the ether through which they pass, the mass of the ether entangled with the tubes being per unit volume proportional to the electrostatic energy of the field in that unit volume. The entangled ether can slide along the line of force, but cannot cross it. This may form the basis for explaining mechanical momentum on electric principles. The lines of force starting from the electrons contained in all matter, grip a certain amount of ether, and the "mass" of the body is really the mass of the ether thus gripped by its electrons. The potential energy of the field is, on this view, the kinetic energy of the turbulently moving ether imprisoned by the lines of force.—*Proc. Cambr. Phil. Soc.*, 12, pt. 2; abstracted in Lond. *Elec.*, May 15.

REFERENCES.

Changing Alternating Current into Two Unidirectional Currents.—BENISCHKE.—An account of some experiments in which he tried to decompose an alternating current into two unidirectional currents by means of a magnetic field, with the aid of an arc between two carbons, one carbon being divided into two halves insulated from each other by mica and each connected to a separate circuit. The experiment is similar to that of Morse and Cushman (ELECTRICAL WORLD AND ENGINEER, Vol. XL, p. 85). The author points out that there are no prospects of applying this experiment to practical use.—*Phys. Zeit.*, May 1.

Electrodynamics.—SCHWARZSCHILD.—A mathematical note in which he shows that the Lorentz-Wiechert theory of electrodynamics may be easily brought into intimate relation to Hamilton's principle.—*Phys. Zeit.*, May 1.

Electrons.—PLATNER.—A theoretical article on the nature of electrons. He considers the electronic hypothesis as suitable for explaining the transmission of electricity, optical phenomena and Faraday's law for electrolytic action, if the electron is considered to be a curl in the ether and not an elementary mass particle.—*Elektrochem. Zeit.*, May.

ELECTRO-CHEMISTRY AND BATTERIES.

Hoepfner Process for the Electrolytic Production of Zinc.—GUENTHER.—A long illustrated article on the Hoepfner zinc process, which was in use in Fuhrfort, Germany, from 1895 to 1897; its discontinuance in 1898 was not due to technical failure, but mainly to personal differences. The raw material was cinder from zinciferous pyrite, mined in Westphalia, the zinc tenor of this cinder varying from 10 to 16 per cent. The preparatory treatment consisted in grinding the cinder, mixing it with common salt, and roasting. The charge was then leached with water or dilute liquor from a subsequent stage. The sodium sulphate was crystallized out by cooling, after which iron and manganese were precipitated by bleaching powder and marble dust and finally the electronegative metals by means of zinc dust. A clear solution of the chlorides of zinc and sodium thus obtained are ready for electrolysis. The anode and cathode compartments were separated by a diaphragm of nitrated cloth. Hard artificial carbons were used as anodes, while the cathodes consisted of discs of zinc or iron, arranged vertically on the horizontal shaft, so as to revolve between a pair of adjacent anode cells; during the electrolysis acid was added; a good deposit could not be obtained from neutral or alkaline solutions. The vats were connected in series and a current density of 100 amp. per sq. meter used; the terminal voltage of the bath was 3.3 to 3.6; in regular operation zinc would deposit on the cathodes in dense form, silver while in color, and the current efficiency was 97 per cent. or more. The chlorine gas liberated by electrolysis was used for making bleaching powder. He gives an estimate of the cost of a plant and operation for producing 650 metric tons of spelter per year and the corresponding quantity of bleaching powder, and reaches the conclusion that the profit in the whole process will be $13,500, as the return on an investment of $162,500 in plant.—*Eng. & Min. Jour.*, May 16.

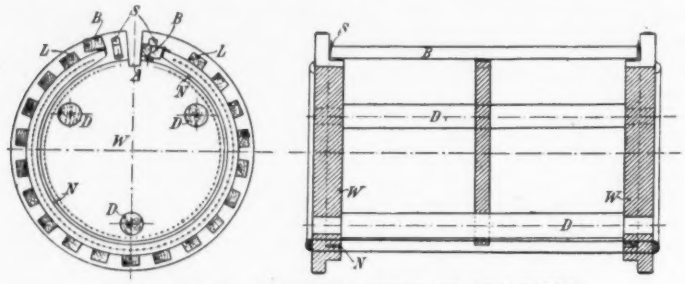
Preparation of the Active Mass for Lead Storage Batteries.—LEIMER.—The conclusion of his article, the first parts of which were noticed in the Digest. The results obtained with the various preparations of the active mass, are given. He divides the various materials used to make the mass more coherent and durable, into two classes: First, those which of themselves are of a pasting nature, like glue; second, those which produce greater adherence by chemical action. To the first group belong cobbler's wax, amber, collodium, gelatine, sugar, etc., which materials give to the lead oxide a strong mechanical firmness and a high electric resistance of greatly varying value. The principle underlying the second class is that a mixture of lead oxides with a chemical substance which changes them mostly into basic lead compounds, which produce a very firm mechanical binding material, whose resistance is relatively very low, and whose durability is also great. To this class belong sulphuric acid, many organic substances, organic and inorganic salts and bases, if free from chlorine. There are some in which the positive active mass is formed with 160 ampere-hours per kg, while the change of minium into peroxide theoretically requires 147; it is possible with a low watt load to get up to 105 amp-hours per kg of positive action mass from the plates; but this was possible only with the best materials of the above second class. In conclusion he mentions the following method of making an active mass: Bring the lead oxides after mixing with pure water and after having been pasted into the frames of grids, into an air-tight closed drying oven, through which the materials which should give greater coherence and durability, were passed in vaporized form; since 1898 batteries, made by this method, have been in continuous operation for benzine automobiles, and have proven very successful. The same method may be successfully used for hardening old plates which have become soft.—*Centralbl. f. Accum.*, March 15.

Siloxicon.—FITZGERALD.—An article on this new compound which was recently patented by Acheson. It is composed of silicon, carbon and oxygen, and promises well as a refractory material in furnaces. It seems to be a new material and to contain various oxygen compounds of carbon and silicon, is of a gray-green color, has a density of about 2.75, is inoxidizable, infusible, neutral, insoluble in molten metals and unaffected by any acid except hydrofluoric. The furnace for making it is briefly described. Many experiments have been tried on siloxicon as a refractory material for lining furnaces, crucible manufacture, etc., and as far as these experiments have gone, the substance promises to be a valuable addition to the industrial arts.—*Eng. & Min. Jour.*, May 16.

Formation of Insoluble Compounds.—ISENBURG.—A long account of experiments on the formation of insoluble (or difficultly soluble) compounds, especially white lead, by electrolysis with soluble anodes, by the method of Luckow. The principle of this method is to use a mixture of two electrolytes with an anode of the required metal, one electrolyte having as anion the required acid radicle, the other being another indifferent salt, the acid radicle of which forms with the anode an easily soluble compound. An example of this method is the formation of lead chromate by using lead as anode and a mixture of potassium chromate and potassium chlorate as electrolyte; when the concentration of the chromate ions is small compared with the concentration of the chlorate ions, the formation of lead chromate goes on easily and the anode remains bright; th latter is explained by the assumption that the formation of lead chromate occurs at some distance from the electrode, namely at the points where the layer of lead chlorate is in contact with the potassium chromate; the lead chromate thus formed cannot adhere at the anode which, therefore, remains bright. The author has studied the analogous process for making white lead and found that in this case also the current efficiency is higher and the lead anode remains in better condition, the greater the amount of the radium chlorate compared with that of the carbonate. The current density was 0.5 amp. per sq. decimeter.—*Zeit. f. Elektrochemie,* April 9.

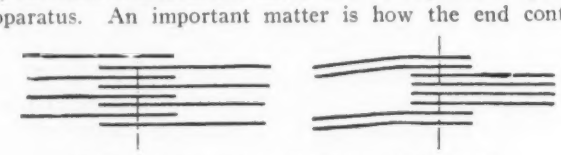
UNITS, MEASUREMENTS AND INSTRUMENTS.

Testing the Magnetic Properties of Sheet Iron.—RICHTER.—An illustrated description of a method developed by the Siemens & Halske Co., of Vienna, in which, as already noticed in the Digest, the iron sheets are tested as a whole and therefore no samples need be cut from them. In the latest form the apparatus is in the shape of a drum in order to enable one to readily place the sheets in the apparatus, and to get as good a distribution of the flux as possible. The arrangement is shown in Fig. 1 and Fig. 2. The sheets are



FIGS. 1 AND 2.—SECTIONAL VIEWS OF APPARATUS.

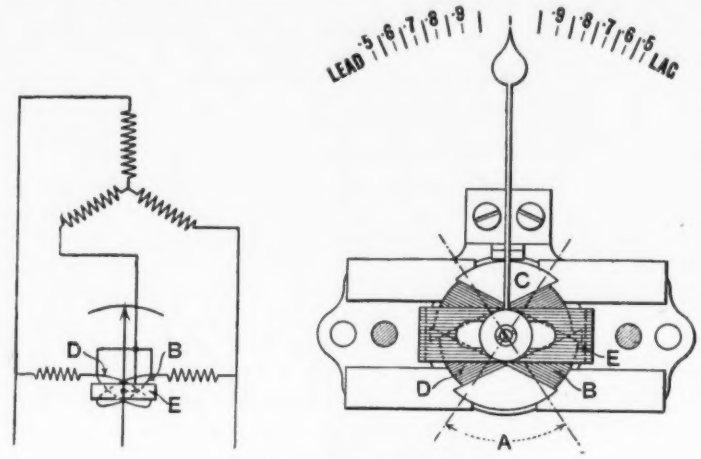
bent so as to form cylinders and are surrounded along nearly the whole circumference by the magnetizing windings. The drum form has the other advantage that the apparatus may be easily rolled from one place to another in the testing room. Fig. 1 is a cross-section and Fig. 2 a longitudinal section of the apparatus. In the side walls, *W*, which are held together firmly by the rods, *D*, the slots, *N*, are provided, into which the sheets are placed. They are introduced at the point, *A*. The magnetizing wires consist of bare copper wire stretched between the side walls, *W*. The wooden rods, *L*, are intended to protect the wires against injury. At the center of the magnetizing windings there is a terminal which enables one to connect the two halves of the winding either in series or in parallel. The dimensions of the sheets tested at the same time should not differ by more than a few per cent.; but he remarks that this is no disadvantage, as it is now proposed by the German Association of Electrical Engineers to have only two standard sizes of sheets; for each standard size there will be required a special testing apparatus. An important matter is how the end contacts of



FIGS. 3 AND 4.—ARRANGEMENT OF SHEETS.

the several sheets are made; the best method which should be used in scientific investigations is illustrated in Fig. 3, while Fig. 4 shows an arrangement which is recommended in practice, and which is said to be nearly as good as the other one. For exact tests only two corrections must be made, the one due to the e.m.f. corresponding to the flux in the iron, the other for the measured watts from which the copper losses are to be subtracted. He remarks, however, that all known methods for determining the loss in dynamo iron sheets are not very exact. The wattmeter method, except in especially equipped laboratories, must be used with the greatest care in order to avoid errors of 4 per cent. For instance, it is impossible to get the exact specific gravity of every sample, which is necessary for the calculation of the iron cross-section from the weight; an average value must be chosen. For this reason not too great an accuracy should be required from the tests of the losses.—*Elec. Zeit.,* May 7.

Power Factor Indicator.—An illustrated description of a direct reading power factor indicator, the design of which is based on the known fact that when two wattmeters, suitably connected, are employed to measure the power on a balanced three-phase system, the ratio of their readings varies with the power factor of the system. The arrangement is illustrated in the adjoining diagrams. If the



POWER FACTOR INDICATOR.

two wattmeter movements are mounted with the moving coil on one axle, and the axes of the fixed coils at a suitable angle, the moving coils being perfectly free to turn without any control, and connected as shown in the figure, the moving coils will take up a position proportional to the phase angle. As the system is assumed to be balanced, the currents in the three-line wires are equal, and it is, therefore, necessary to have only one moving coil. *B* and *D* are two fixed coils of wire wound in annular grooves in the insulating former, *C*, which have their axes inclined at a suitable angle, *A*, according to the length of scale required for a given power factor, and are so wound that their magnetic fields are equal. The moving coil, *E*, is free to turn without any control, the electromagnetic forces being so large that friction, etc., is negligible. With a unity power factor the moving coil sets itself into the position where the forces exerted by the two fixed coils are equal; that is, midway between the coils *B* and *D*. In this position the pointer indicates 1 in the center of the scale. If the amperes are lagging behind the volts, the fixed coil, *D*, exerts less force on the moving coil than the fixed coil, *B*, and the moving coil is, therefore, drawn over to the coil, *B*, until the two forces are again balanced. Thus, on a lagging power factor of 0.5, the free coil, *E*, will be co-axial with the fixed coil, *B*, and the pointer will indicate 0.5 lag on the dial. The instrument is made dead beat by means of a damping dis carried by the moving coil, *E*, and moving between the poles of a permanent magnet.—Lond. *Elec.,* May 18.

Measuring Very Low Resistances.—RENNIE.—A communication in which he comments on a method recently described and in use in the German Reichsanstalt for comparing very low resistances, and which he thinks is too complicated. He is of the opinion that a more promising method for this important class of measurement will be found on the lines of the differential galvanometer method. The present form of the Craley arrangement has shown itself amply capable of giving results to 1 in 10,000, while an accuracy of 1 in 1,000 is easily obtained. It is, therefore, thought that it is in the direction indicated by the differential galvanometer that progress is to be sought.—Lond. *Elec.,* May 1.

REFERENCE.

Goldleaf Electrometer.—WILSON.—An illustrated description of a very sensitive gold leaf electrometer. The gold leaf is opposite

to a rectangular insulated brass plate in a box which is placed in an inclined position to adjust the sensitiveness of the instrument.—*Proc. Cambr. Phil Soc.*, 12, pt. 2; abstracted in Lond. *Elec.*, May 15.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCES.

Divided Multiple Switchboards.—AITKEN.—The first part of an illustrated paper read before the British Institute Electrical Engineers on divided multiple switchboards as an efficient telephone system for the world's capitals.—Lond. *Elec. Rev.*, May 15.

Wireless Telegraphy.—PRASCH.—The first part of what appears to become a long illustrated serial on recent improvements in wireless telegraphy. In the present issue the Slaby-Arco system is discussed.—*Dingler's polytech. Jour.*, May 2.

MISCELLANEOUS.

Acetylene Central Stations.—VOGEL.—A lecture, held before the German Acetylene Society on the development of acetylene central stations for lighting towns in Germany. He thinks that now, after experience has been gained, the commercial prospects are much more promising, and recommends the erection of an acetylene central station for any town having a population of about 8,000 or 10,000 or less; the houses must not be scattered too much; there should be at least about 150 lights for each kilometer of street pipe, if the gas is to be sold at 45 cents per cubic meter, the present price of calcium carbide in Germany being $7 per 100 kg. The operation is claimed to be much simpler than that of any other gas works. The chief advantage is that the first cost of the plant is very low; for a town of 4,000 or 5,000 inhabitants with a pipe network of 8 km length, with 80 to 100 street lamps and a total of 1,500 connected lights, and a gas reservoir of 100 cubic meters capacity, an acetylene central station costs $17,500, while an electric plant costs $50,000. Reports from physicians state that the acetylene light is the best for reading.—*Zeit. f. Calciumcarbid Fab.*, April 3.

Acetylene Central Station.—An illustrated description of the acetylene central station in Doese, Germany.—*Zeit. f. Calciumcarbid Feb.*, May 8.

Acetylene.—KEPPELER.—The conclusion of his article on impurities in commercial acetylene and on its purification.—*Zeit. f. Calciumcarbid Fab.*, May 1.

Engineering Education.—DALBY.—A paper read before the British Inst. Mech. Eng. on the education of engineers in America, Germany and Switzerland.—Lond. *Elec.*, May 1.

Biographical.—BENJAMIN.—An account, with portrait, of the life and work of Alexander Graham Bell.—*Sc. Am.*, May 2.

New Books.

THE INDUCTION MOTOR. Its Theory and Design Set Forth by a Practical Method of Calculation. By Henri Boy de la Tour. Translated from the French by C. O. Mailloux. New York: McGraw Publishing Co. 200 pages, 75 illustrations. Price, $2.50.

Mr. Mailloux's translation of M. De la Tour's treatise on "The Induction Motor" is a valuable addition to English engineering literature. The ever increasing importance of the induction motor and the desirability of extending a thorough knowledge of its working to wider circles than the designing engineer, have made Mr. Mailloux's translation a most timely one.

The French edition was reviewed at length May 10, 1902, in these columns. The American edition is, in many respects, superior to the French original. Not only the type, the diagrams and the paper are excellent, but the book contains a chapter on the Heyland motor, which is not embodied in the French edition. This chapter, which was written by M. De la Tour expressly for the American edition, is a succinct statement of the theory of this interesting machine. Another valuable addition is an introduction by Mr. Mailloux, whose literary art, moreover, makes the book extremely agreeable reading. We can heartily commend the work to those interested in the theory of the induction motor.

ELEKTRISCHE STRASSENBAHNEN. By Johannas Zacharias. Vienna: A. Hartleben. 240 pages, 128 illustrations. Price, 5 marks.

"Electric Streetrailways" is the literal translation of the title of this pamphlet, which is a small manual, descriptive of German practice in building electric railways. The book is divided into six chapters, the first of which deals with track construction, the second with the overhead line, the third with street car motors, the fourth with power stations, while the fifth and sixth are descriptive of some of the most prominent German installations. The work is almost entirely non-mathematical in character, but is generally descriptive of modern practice.

DIE BAHNMOTOREN FÜR GLEICHSTROM. By M. Muller and W. Mattersdorff. Berlin: Julius Springer. 418 pages, 231 illustrations and 11 plates. Price, 15 marks.

This is a treatise which, as its name indicates, is exclusively confined to a discussion of railway motors for direct currents. In America the latter half of the title would seem superfluous, as we are but just beginning to dream of alternating systems for railways, but evidently in Germany the progress has been such that the authors feel it essential to qualify their work by limiting it to its exact sphere. The book is certainly the most complete treatise on electric railway motors that has appeared, excepting possibly that of Blondel et F. Paul Dubois, "La Traction Electrique." The "Bahnmotoren," however, is limited to street car motors exclusively and does not deal with any other features of the electric railway.

The first two-thirds of the volume are devoted to the principles of dynamo machine construction, particularly applicable to street car motors and the various modifications which practice has shown desirable. The last third of the volume contains some excellent illustrations of the actual construction of street car motors in all of the representative types. An interesting and attractive feature to the practicing engineer is the profusion of dimensions which are given, for each motor is accompanied with a description giving the sizes of the various parts.

Finally, the volume concludes with 11 large folding plates, each containing a working drawing of a standard motor, giving its various dimensions and accompanied by the characteristic curves, from which the railway engineer can easily select such a motor as will best fill the schedule he desires to accomplish. In this respect the work is unique.

DIE FUNKENTELEGRAPHIE. By C. Arldt. Leipzig: Theod Thomas. 72 pages, 75 illustrations. Price, 1.80 marks.

In "Spark Telegraphy," to translate literally, the German appellation of this pamphlet—the author has given quite a full resumé of Hertzian signalling up to date. The volume is purely descriptive in character, the excellent illustrations showing the more modern forms of induction coils, mercury circuit-breakers and Wehnelt interrupters. Next come diagrammatical illustrations of all the various forms of transmitting and receiving circuits that have been tried. The last third of the pamphlet is devoted to an illustrated description of the most prominent wireless telegraph stations, both on land and afloat.

DIE GRUNDGESETZE DER WECHSELSTROMTECHNIK. By Dr. Gustav Benischke. Braunschweig: Frederick Vieweg & Sohn. 141 pages, 113 illustrations. Price, 4.20 marks.

"The Fundamental Principles of Alternating Current Technics" is a somewhat free translation of the title of this volume. It is a book that is entirely mathematical in character, in which alternating currents are taken up and discussed in 140 pages. There is nothing particularly novel in the work, for it is generally a condensation into a more compact form of the principles of alternating currents that have already received treatment at the hands of many authors. In so far as the present book eliminates that which has become too thoroughly familiar it will be an addition to the electrician's library.

Directory of Electrical Societies, Etc.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, C. J. Reed, 929 Chestnut Street, Philadelphia, Pa.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, 95 Liberty Street, New York. General meeting, Niagara Falls, June 29, July 3.

AMERICAN ORDER OF STEAM ENGINEERS. Secretary, Frank C. Rose, 10 Federal Street, Pittsburg, Pa.

AMERICAN STREET RAILWAY ASSOCIATION. Secretary, T. C. Pening-

ton, 2020 State Street, Chicago. Next meeting, Saratoga Springs, N. Y., September 2, 3 and 4, 1903.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, W. H. Johnson, Philadelphia, Pa.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Colby and Abbott Building, Milwaukee, Wis. Next meeting, Indianapolis, Ind., third Wednesday in June, 1904.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, C. H. Mortimer, Toronto, Ont. Next meeting, Toronto, Ont., 1903.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Wm. J. Davis, Ithaca, N. Y.

THE ELECTRICAL TRADES SOCIETY (Member National Electrical Trades Association). Secretary, A. P. Eckert, 39 Cortlandt Street, New York. Board of Directors meets every second Friday of each month.

ENGINE BUILDERS' ASSOCIATION. F. P. Ide, Springfield, Ill., Secretary.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. ext meeting, Atlantic City, N. J., September 2, 3 and 4, 1903.

INTERSTATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. M. Coleman, Louisville, Ky.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary's office, 136 Liberty Street, New York. Next meeting, Boston, Mass., 1904.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. B. Ware, Ellicott Sq. Building, Buffalo, N. Y. Next meeting, Chicago, June 24 and 25.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 104 Liberty Street, New York.

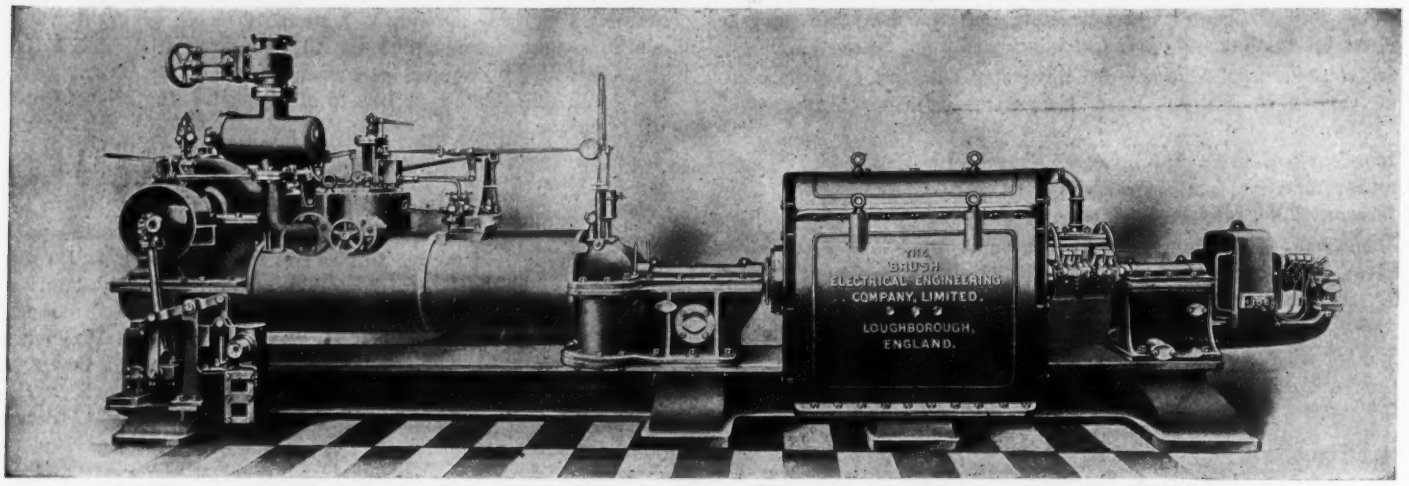
NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, T. R. Mercein, 85 Michigan Street, Milwaukee, Wis.

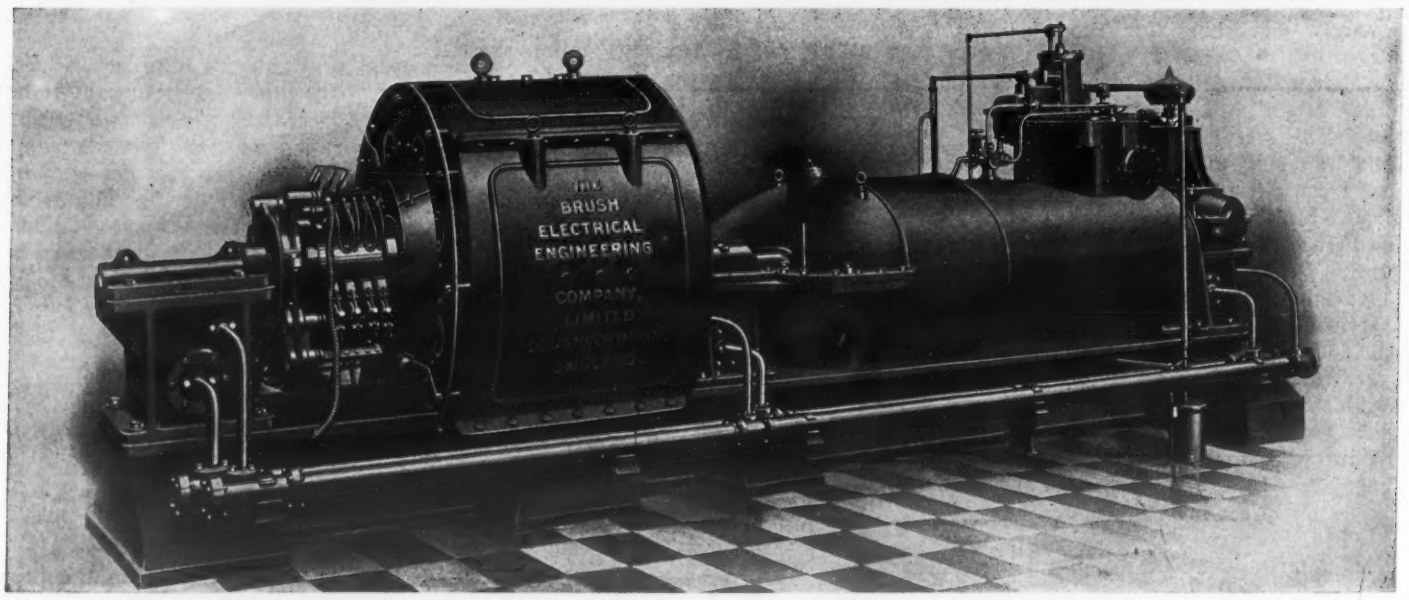
SOUTHERN INDIANA TELEPHONE ASSOCIATION. Secretary, E. W. Pichardt, Huntingburg, Ind.

English Turbo-Generators.

We illustrate herewith an English turbo-generator set made by the Brush Electrical Engineering Company, of London, which company has obtained full license to build and sell the Parsons turbine. This type is so well known that it hardly requires description. The company will build this turbine in all capacities up to 10,000 kw for direct-current or alternating-current generators.

One of the cuts show a Parsons turbine direct-connected to a 300-kw Brush alternator, and another shows it used in connection with a Brush direct-current generator. The company has also obtained a license under the Heyland patent to manufacture synchronous, single-phase and polyphase inductor generators. These are especially suitable for connections to turbines, and have the advantage of being self-exciting, with a facility for paralleling unknown in other machines. The actual drop with any power factor is said to be only 3 per cent., and if desired the machine can be compounded or even over-compounded.





FIGS. 1 AND 2.—ALTERNATOR AND DIRECT-CURRENT GENERATOR, DIRECT-CONNECTED TO PARSONS TURBINES.

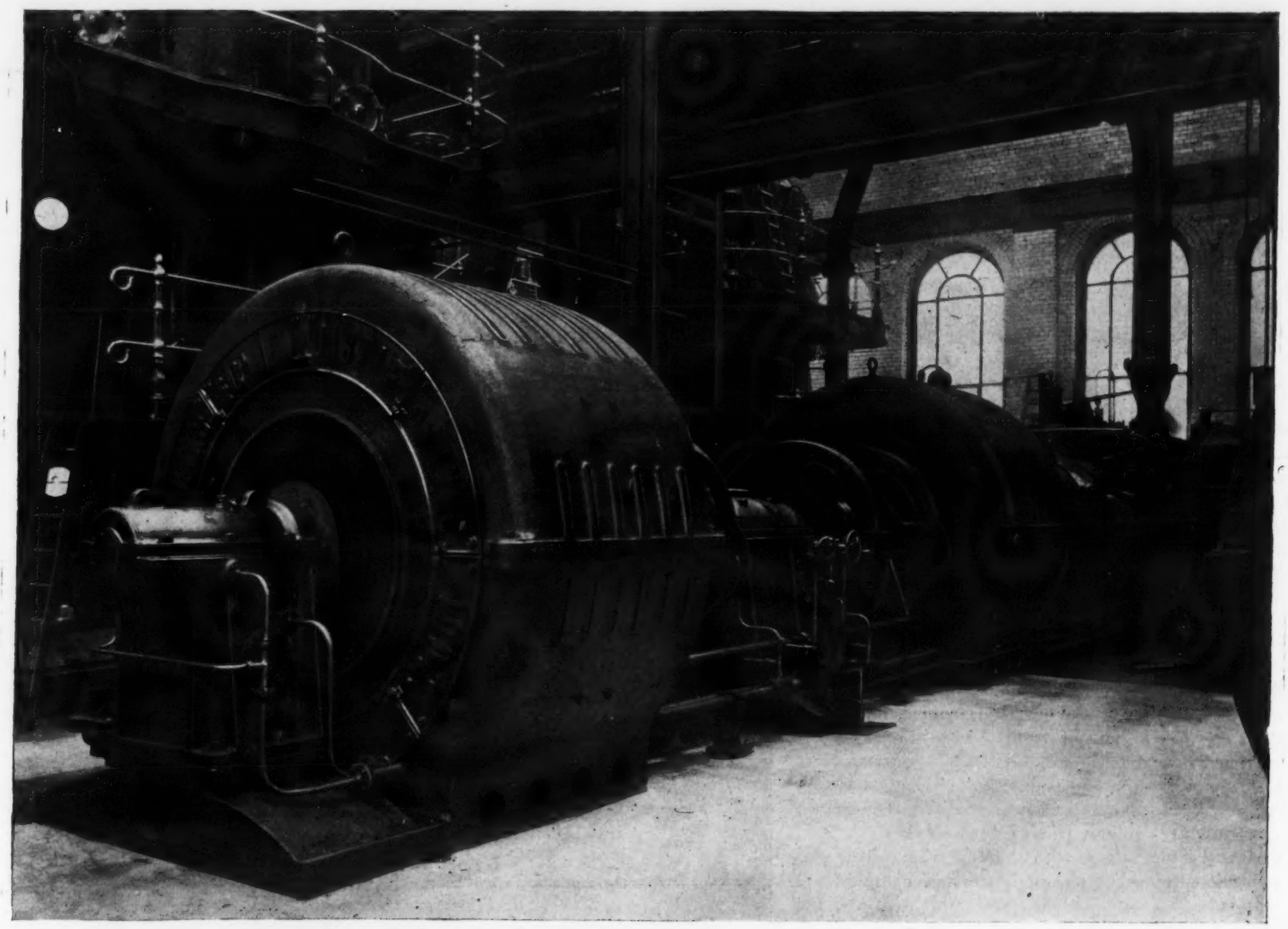
Steam Turbine Plant of the Manchester Corporation, England.

One of the largest and best municipal central station systems in England is that of the Manchester Corporation. It includes two plants, the total output from which has reached 13,200 amp., for light, power and traction. To the Dickinson Street Station have recently been added two turbo-generators built by C. A. Parsons & Co., as illustrated in the accompanying cut.

The equipment comprises two 2,500-hp Parsons steam turbines, each driving two separate six-pole, continuous-current, 1,800-kw dynamos coupled directly in tandem. The dynamos are intended for the lighting circuits only, are shunt-wound and capable of giving a voltage of from 400 to 450 volts. The armatures are coupled so that the commutators are together; they are surface-wound and weigh 10 tons each.

The condensing apparatus is of the jet type, fitted with Parsons compound air pumps driven directly by a 20-B.hp shunt motor running at 110 r.p.m. and of Siemens Bros. design. The discharge is effected by a Gwynne centrifugal pump, driven by a Siemens shunt motor of 80 B.hp and running at 500 r.p.m. Provision is also made for exhausting into the atmosphere when necessary, an automatic valve being provided for this purpose.

The total weight of each machine complete without condenser is 85 tons, slightly over 0.2 of the total weight of one of the Bloom Street Musgrave-Westinghouse reciprocating sets, and about 0.7 of the weight of the fly-wheel. The floor space occupied is 47 ft. 6 in. x 8 ft. 6 in., or 400 sq. ft.; i. e., 0.22 sq. ft. per kw. The average height is only 9 ft., while the highest point does not exceed 11 ft., all measured from floor level. The guaranteed steam consumption with 27 in. vacuum at full load is 20 lbs. per kw-hour, and at half-load, 23 lbs., the steam pressure at the stop valve being 125 lbs. per sq. in. without superheating. The armatures are connected up in parallel with each other, and an automatic brush rocking gear is fitted to each and actuated from the turbine so that the brushes are at the best position on the commutators at any load. The turbines are of the Parsons latest design for the power—viz., one cylinder, compound, parallel flow type, running at a speed of 1,040 r.p.m. It is fitted with mechanical governors which so govern the speed that from no load to full load the difference does not exceed 3 per cent. The first machine has now been running on load daily since the latter part of 1902, and has proved in every way satisfactory to the technical staff. The absence of vibration is most noteworthy. It is said, in fact, that if it were not for the slight noise made by the rapid whirr of the armatures and that caused by the brushes on the commutators it would be practically impossible to determine whether the units were running or not.



STEAM TURBINE PLANT, MANCHESTER, ENGLAND.

Wireless Telegraph Earnings.

In a booklet recently issued by Messrs. Munroe & Munroe, the following statement with reference to the earning power of the Marconi stations is made: "The earning power of these two stations (Wellsfleet and Glace Bay) when completed and in running order is a matter of easy computation. The practical maximum speed thus far attained by the Marconi system is thirty words a minute. An average of eighteen words per minute would be a safe basis for calculation. The cable charge for trans-Atlantic service is 25 cents a word. Assume the wireless charge to be an average of 10 cents a word, and the daily earning capacity of one station is over $2,500, or $925,000 per year. This earning capacity may be doubled by an increase of speed to the maximum attained; it may be increased tenfold, if it proves true that the same results may be achieved in transmitting messages across the Atlantic that have been achieved in transmision across the English channel." As to what users of the system may save, it is said: "In the case of the French ship which went ashore on the Goodwins, we have the evidence given in the Admiralty Court that by means of one short wireless message, property to the amount of $272,940 was saved."

3,000-Kw. Generating Units for the London Metropolitan Central Station System.

The largest generating sets thus far operated in Europe have recently been installed in the generating station of the Metropolitan Electric Supply Company at Willesden, London. These consist of two 3,000-kw, two-phase, direct-connected generators, each set being designed to operate at a speed of 75 r.p.m., and a frequency of 60 cycles. These generators operate in parallel with the existing 1,500-kw Westinghouse generators, which are of the revolving armature type, designed for 500 volts per phase, and stepped up to the bus-bar pressure of 10,500 volts, or thereabouts, by means of 8,000 kw of step-up transformers.

The engines, which were made at the Sulzer works, Winterthur, Switzerland, are rated at 5,000 hp and are of the vertical three-cylinder compound type, the high-pressure cylinder being in the center. The crankshaft is extended at one end, in order to carry

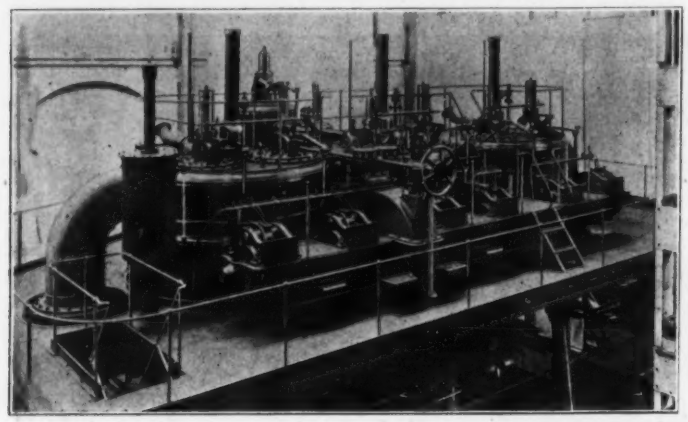


FIG. 1.—VALVE GEAR.

the revolving field of the generator, and the shaft projects beyond the outboard bearing, in order to allow the exciter armature to be mounted directly upon it. The engines are designed to work with a normal steam pressure of 150 pounds per square inch at the stop valve, with a normal vacuum of 28 in., and without any superheating whatever.

The valves and valve gearing of the engines are of the Sulzer type. The admission and exhaust valves are four-seated poppet valves, combining a very large port area with small clearances. They are placed in the upper and lower cylinder heads, to insure the shortest possible steam passages and the least clearances. The valves are operated from a horizontal shaft carried in an oil trough with the necessary bearings. This shaft is driven from a vertical shaft by means of a pair of spiral gears (bronze and steel) running in oil, and the vertical shaft itself is driven by means of a similar pair of gears from the crankshaft. All the valves, with the exception of the two admission valves of the high-pressure cylinder, are actuated by eccentrics in connection with rocking levers, the latter being arranged with long strokes on the ends opposite the valve rods in order to be able to obtain large curves. These levers give very favorable leverage at the moment of opening, fast motion afterwards and very soft closing motion again. The two admission valves of the high-pressure cylinder are operated by a releasing gear, which is varied by the governor from 0 per cent. to 55 per cent. cut off. The governor is mounted directly upon the vertical shaft before mentioned, in order to do away with an indirect drive. It can be altered by hand, while the engine is running to give speed variation of 5 per cent. There is also an automatic emergency governor provided, which comes into operation when a certain prearranged speed is attained and the vacuum destroyed, thus effectually providing against racing.

The economy guarantees are that at the stop-valve pressure of 150 pounds per square inch, and with a vacuum of 25 in. the consumption of dry saturated steam will not exceed the figures given below, and that the efficiencies will be greater than the values given in the second column:

It is claimed that should these engines ever be operated with steam superheated to say 117° F. (65° C.) above the temperature of saturated steam at 150 pounds per square inch, the steam consumption figures will be as under:

	Steam consumption per ihp-hour, lbs.	Mechanical efficiency excluding air pump friction, etc., %.
Full load	15	92.5
Three-quarters load	14	90
One-half load	14	86

Full load	13¼ lbs. per ihp-hour.
Three-quarters load	12½ lbs. per ihp-hour.
One-half load	12½ lbs. per ihp-hour.

The generators were made by Kolben & Co., of Prague, Bohemia. Each generator is of the two-phase revolving field type, with stationary external armature and direct-coupled overhung exciter. The maker's rating of each generator is 3,500 kw, at a pressure of 10,500 volts per phase at 60 cycles, when driven at a speed of 75 r.p.m. But each generator has to be capable of giving an output of 3,000 kw at any pressure between 10,000 volts and 11,500 volts per phase. Actually each generator was guaranteed to give a continuous output of 3,000 kw upon a non-inductive load at a pressure of 11,000 volts per phase, for a period of twenty-four hours, with a temperature rise in any part of the generator or exciter of less than 70° F. above that of the surrounding atmosphere. The trials of the first machine have shown that the actual temperature rise, under these exact conditions, is only 45° F.

Each generator was, moreover, guaranteed to carry a non-inductive overload of 25 per cent., or 3,750 kw, for a period of four hours without undue heating or undue pressure drop. Trials on the first set (working non-condensing with high-pressure steam in low-pressure cylinders) have further shown that this overload can be carried with a pressure drop of only 8 per cent. from no load to full load at constant speed and excitation. The efficiency of the generators when working upon non-inductive loads including the excitation and ventilation losses as at full load, is 96 per cent.; three-fourths, 95 per cent.; one-half, 93 per cent.

The insulation of the armature windings withstood for a period of 20 minutes 30,000 volts, alternating, applied between the two phases, and 20,000 volts, alternating, applied between the windings of either phase and the (earthed) armature core.

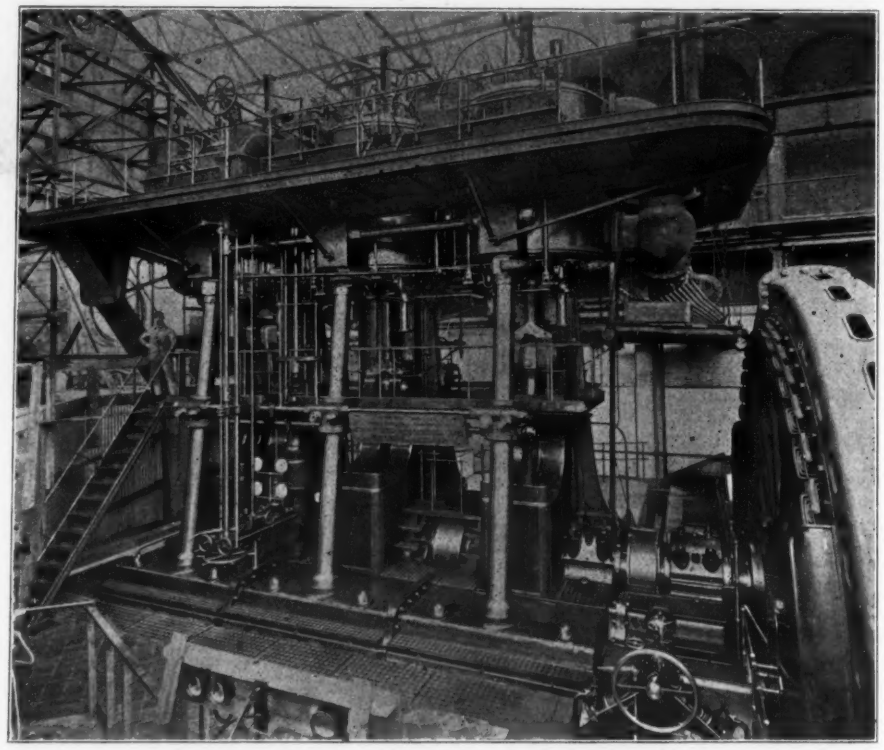


FIG. 2.—VIEW OF ENGINES, SHOWING UPPER GALLERIES.

The cast-iron armature case is in four pieces, secured by means of bolts and eight shrinking rings. The lower half of the casing, which is subjected to the greatest stresses, is supported below in the pit. In order to render the armature coils readily accessible at any time for cleaning or inspection the whole armature is capable

of being moved in a direction parallel to the shaft, and suitable screw gear is provided for effecting this movement. The armature core discs are built up inside the casing and are secured to the latter by means of dove-tails. The armature coils are first form-wound in the micanite tubes, and then carefully taped and varnished.

The revolving field of each generator has a steel rim having a stiff U section, and being united to the center boss by means of twelve pairs of radial arms. This wheel is constructed in four sections, which are united by means of bolts and heavy shrinking rings. The center boss or hub, which is carefully keyed to the extended crankshaft, is also secured by means of bolts and shrinking rings, the latter having a section of 36 sq. in. The 96-pole cores are of the softest cast steel, of oval section, with the laminated pole shoes cast in with them.

The magnet windings consist of copper, strip-wound on edge, the adjacent layers of this strip being insulated by means of special parchment paper insulation, having a thickness of about 1-50 in. The slip rings which serve to lead the exciting current into the field winding are of phosphor bronze and are carried on a cast-iron spider. The brushes for these rings are of block carbon, the current density at the bearing surfaces being about 30 amp. per square inch.

Each exciter consists of a multipolar generator with cast-steel field system and a slotted, form-wound, drum armature of the series-parallel type. This is rated at 250 amp. and 150 volts. The brushes are of block carbon, and press upon the commutator, which is constructed of hard-drawn segments insulated by mica.

Ferranti & Co. supplied the switchboard, and it consists of three

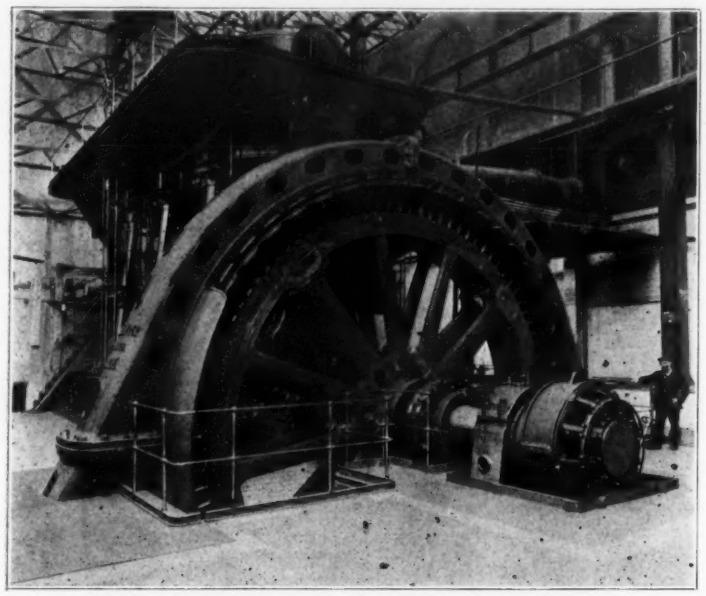


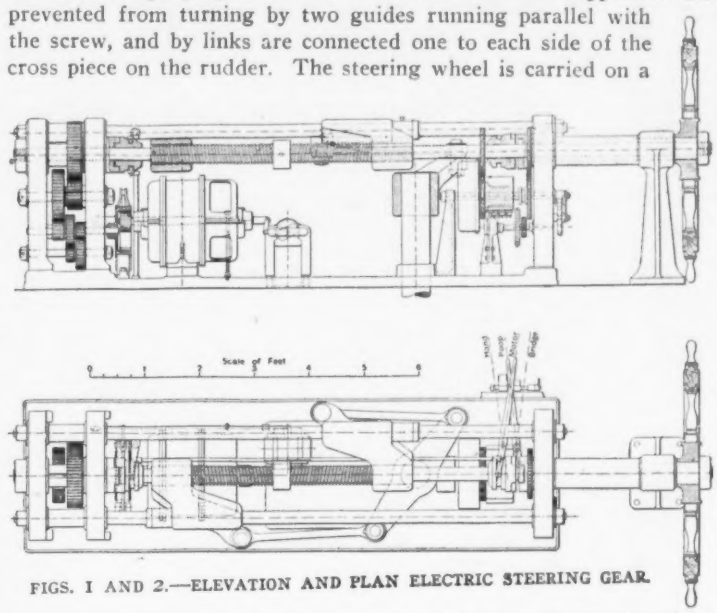
FIG. 3.—3,000-KW GENERATOR DIRECT-CONNECTED TO 5,000-HP ENGINE.

sections, one for each machine, and the third for the outgoing cables and forming an interconnector panel, enabling either of the machine panels to be made dead for cleaning purposes or for killing either pair of outgoing mains whilst under repair. The board is built for 11,000 volts and to control two 3,000-kw, two-phase alternators, and is complete with exciter gear, synchronizing arrangements and all necessary switches, fuses and instruments. The main frame is formed of horizontal enameled slate slabs, 3 in. thick, built into the engine room walls and divided into cells by vertical partitions.

The bus-bars are rectangular, 0.5 sq. in. in section, and totally enclosed in an insulated chamber, provided with plug sockets to enable any particular panel to be isolated. Oil-break fuses are provided for each phase, capable of safely breaking 200 amp. at 11,000 volts. The fuse is three-fourths of an inch long and drops into 24 in. of oil. Oil-break switches are used, one in each phase, capable of breaking 1,500 kw at 11,000 volts. The interconnector panel is supplied with oil-break switches also, but not for breaking full load, and also carries the cable receivers. All transformers are dry insulated. The wattmeters are recording and indicating, and are connected through the outer or earth side of the circuit. These meters, it is hoped, will not be affected by the power factor or change in periodicity. Single-pole shunt and main field switches are included, each with field-breaking switch arrangements.

Electric Steering Gear on an English Yacht.

An electric steering gear has recently been installed by Siemens Bros. & Co., of London, aboard a yacht, one of the features of which is that the usual hand steering gear needs but slight alteration to adapt it to electrical control. The upper end of the rudder post passes through the base of a cast-iron frame bolted to the deck, and to it is keyed a massive cross piece, above which and running fore and aft is a right and left-handed screw supported by the frame and carrying one right and one left-handed nut, as shown in the accompanying illustrations. These nuts are supported and prevented from turning by two guides running parallel with the screw, and by links are connected one to each side of the cross piece on the rudder. The steering wheel is carried on a

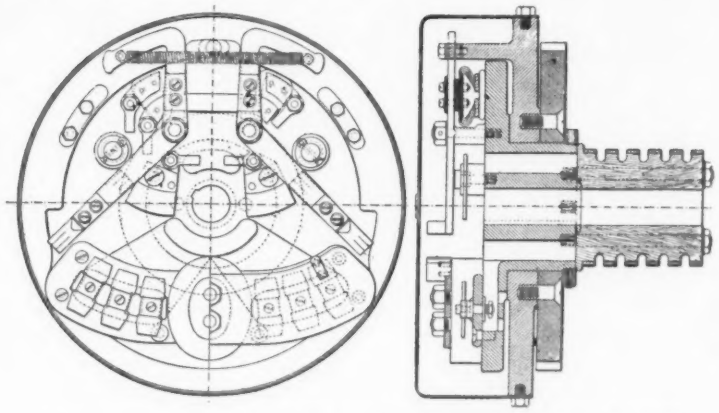


FIGS. 1 AND 2.—ELEVATION AND PLAN ELECTRIC STEERING GEAR.

sleeve on an extension of the screw, to which it can be connected by means of a claw clutch.

A four-pole motor, completely enclosed, is arranged to drive the screw through several reductions of spur gearing and a clay clutch, which is connected to the clutch on the steering wheel in such a manner that both are operated by one lever, and only one can be in gear at a time. It will thus be seen that the screw, which operates the rudder through the nuts and links, is capable of being turned either way by the motor, or by the steering wheel, but not by both at the same time. The motor is series-wound, and provided with a brake pulley and brake blocks which are held off by an electromagnet in series with the motor and held on by a suitable spring. The brake is, therefore, put on and the motor promptly pulled up whenever the current is interrupted.

The motor is controlled by a special hunting switch with two levers and two sets of contacts, one for each direction of rotation.



FIGS. 3 AND 4.—ELEVATION AND SECTION ROTARY HUNTING SWITCH.

This arrangement, which is shown in Figs. 3 and 4, was adopted instead of a single reversing switch in order to get a very reliable quick break action. Each switch has three contacts, so that resistance can be cut out in two steps, and they are so shaped that the actual contact surfaces are not touched by the arcs and therefore remain in good condition. They are reversible and can be easily replaced, the insertion of new ones occupying but a few minutes. A powerful magnetic blow-out, which operates upon all the contacts, is provided on each switch. Although the current is not more

than 25 amp. at 100 volts, these ample precautions against arcing troubles have been taken because of the extremely frequent switching off and on which is required in the ordinary steering of a ship, and in practice they have proved quite satisfactory.

The two switch arms are mounted on two pins at equal distances from the center of a metal disc geared to the steering wheel. They are cranked as shown, and are so arranged as to be operated by stops fixed to a second disc mounted concentrically with the first. The second disc is in gear with the screw and its motion is therefore proportional to that of the rudder. The switching on or off is, therefore, the result of the difference in the motions of the two discs, which are proportional to that of the rudder and the steering wheel respectively.

The cranked arm of each switch is so shaped that it clears the stops on the second disc when the motion is in one direction, but engages them when the motion is in the opposite direction. This insures that one switch only is operative in each direction of rotation. In order to obtain a quick break, both switches are pulled to the

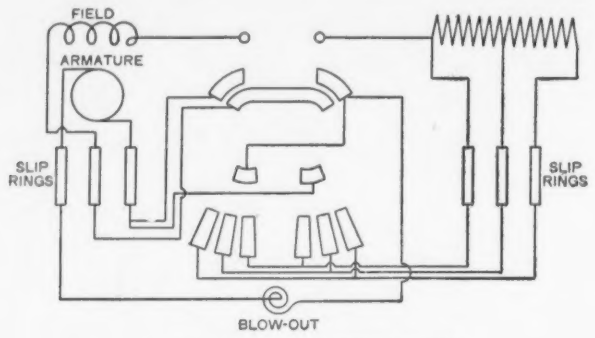


FIG. 5.—DIAGRAM OF CONNECTIONS.

"off" position by springs, but they are also forced off positively by the stops, so that the breaking of a spring would not incapacitate the gear in any way, but only make the break rather slower. The two discs are provided with massive stops arranged to limit the difference of their motion to little more than the amount actually required to operate the switches.

The gearing is such that twelve complete turns of the steering wheel move the rudder from hard-a-port to hard-a-starboard, a total angular distance of 80°. A Geneva stop, in connection with the second disc, prevents the steering wheel from turning more than twelve complete revolutions, and when the second disc is brought to rest by the stop the first catches it up. The motor is thus automatically switched off when the extreme positions of the rudder are reached.

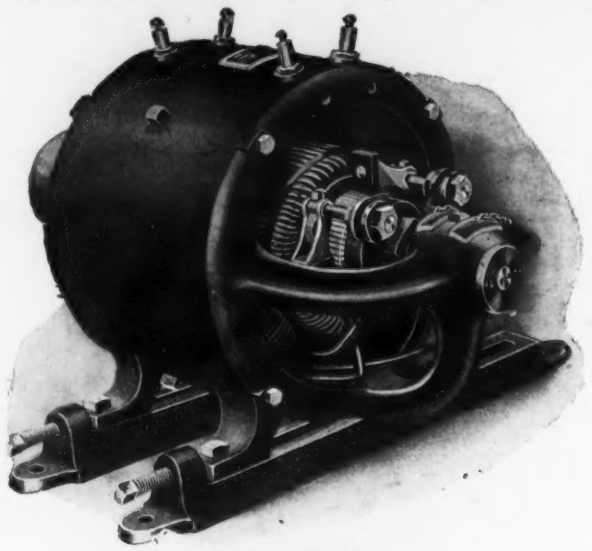
The gear as installed in the yacht has amply proved its efficiency, and gave complete satisfaction to the navigating officers, the control of the ship being as perfect as could be desired. The test imposed, which was considered the most severe, namely, throwing the rudder from hard-a-port to hard-a-starboard while steaming full speed astern, was accomplished with ease and without excessive consumption of current. When steered by hand the gear requires the combined energies of four or more men, according to the state of the weather.

Two Kilowatt Dynamo.

The 2-kw dynamo illustrated here is one of a line ranging from one-half to 20-kw, manufactured by the Hobart Electric Manufacturing Company, of Troy, O. This line has been developed with the idea in mind that most electric machines of small and moderate size go into places where they are handled by inexpert persons. This requires simplicity of all parts and a minimum of necessary adjustments. Such machines should be thoroughly well built both mechanically and electrically, that they may stand abuse. Hence all parts have been made as strong as is consistent with good engineering practice. They have also been rated very conservatively and are, therefore, not only capable of giving their rated output continuously without distress, but will also withstand severe temporary overloads.

The construction is of the conventional multipolar type, with radial pole pieces mounted in a circular frame, both frame and pole pieces being of Tropenas steel. In most of these machines the pole pieces are cast separately from the frame and bolted to the same. The seats for the pole pieces are turned concentrically with the shaft and give a joint of very low magnetic resistance.

The field coils are layer wound and are of a circular cross-section. Before being placed on the pole pieces they are very carefully insulated so as to withstand unusual strains. The armature has been the subject of unusual care, both in design and in construction, and is the iron-clad type. The coils are straight out and thoroughly insulated before being placed in the slots which are previously additionally insulated to receive them. A good-sized commutator is



2-KW DYNAMO.

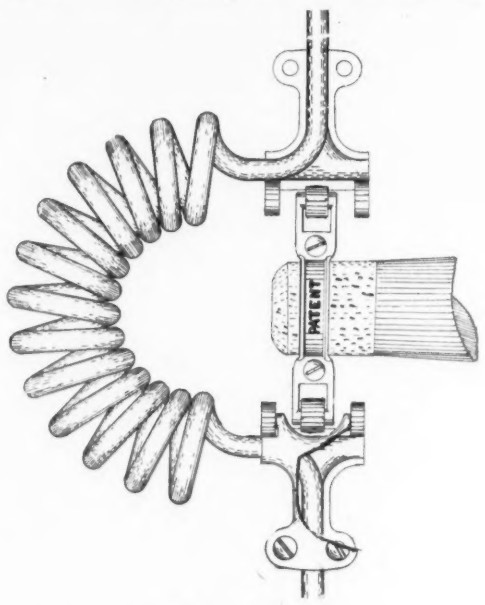
also characteristic of this line, thus reducing the heating and giving plenty of stock for wear.

In the construction of these machines a novel feature is introduced in the bearings. These are large and self-aligning, and have a special arrangement for centering the armature with the magnetic center of the frame. This device overcomes a frequent fault—that the magnetic pull on the armature draws it strongly against one bearing, thus preventing end motion and causing the brushes to wear grooves in the commutator.

Not infrequently an armature improperly centered pulls so strongly against one bearing as to cause it to run hot persistently. This improvement is, therefore, one that will be greatly appreciated by practical men. Jigs are used in drilling all parts, and all turning is done to gauges, thus insuring correct fitting and alignment of all parts.

Stirrup for Arc Lamp Suspension.

Managers of electric light plants have long felt the necessity for a device to prevent the bending strain in wires transmitting energy to movable apparatus. In the operation of raising and lowering arc lamps, for instance, the wires frequently break at the insulation arm above the lamp or at the pole, and the swaying from side to side by the wind causes the wire to break at the binding post. These have been sources of considerable trouble ever since electric lighting first came into commercial use, and the device illustrated herewith, known as the 'Shickluna Vita Stirrup," has been designed for the purpose of overcoming these annoyances.



ARC LAMP STIRRUP.

The stirrups are applied at the insulation arm above the lamp, and in some cases at the pole as well, especially if it is necessary to have the wire drawn tight from the pole to the clamp. This device is manufactured by the White Star Appliance Company, 316 Potomac Avenue, Buffalo, N. Y.

Exhibits at the National Electric Light Convention.

THE ROEBLING CONSTRUCTION COMPANY was represented by J. T. W. Montgomery.

RIDGWAY DYNAMO & ENGINE COMPANY were represented by Mr. W. Sharpe, of Chicago.

OTIS ELEVATOR COMPANY were well spoken of by Messrs. Ray D. Lillibridge and J. D. Sheldon.

STANLEY INSTRUMENT COMPANY, of Great Barrington, Mass., sent S. O. Ochs and F. J. Alderson.

WESTINGHOUSE, CHURCH, KERR & Co. had on hand in their interests Mr. E. Yawger, of Pittsburg.

WASHINGTON CARBON COMPANY was appropriately represented by its well-known secretary, Mr. J. S. Krider.

SIMPLEX ELECTRIC COMPANY, of Boston, were represented by W. W. Tenney, of Chicago, and J. G. Brobeck.

GOULD STORAGE BATTERY COMPANY had present in its behalf Messrs. A. S. Hubbard, E. Lyndon, H. B. Oakman, E. L. Draffen.

AMERICAN STEEL & WIRE COMPANY.—Messrs. C. S. Knight, Jr., and F. A. Keyes were busy for the A. S. & W. specialties.

SIMPLEX ELECTRIC HEATING COMPANY had a worthy representative in Mr. J. I. Ayer, past president of the association.

NATIONAL CONDUIT & CABLE COMPANY were vouched for by W. S. Eckert, H. F. Tate, J. B. Honan, W. H. Pearl, F. B. Switzer.

PASS & SEYMOUR'S well-known porcelain insulators, etc., were shown and described by Messrs. B. E. Salisbury and J. W. Brooks.

ROSSITER, MACGOVERN COMPANY, of New York, had a dignified and adequate representation in President MacGovern and Mr. J. A. Peirce.

SAWYER-MAN ELECTRIC COMPANY, whose lamps bespangle the huge Auditorium, was also duly advertised by T. H. B. Whipple and F. S. Smith.

MCINTOSH, SEYMOUR & Co., the Auburn (N. Y.) engine builders, were present in the person of Mr. J. A. Seymour, of the executive department.

ELECTRIC STORAGE BATTERY COMPANY was represented by Messrs. Charles Blizard, general sales manager; G. H. Atkin, Otto E. Osthoff, G. W. Hill, H. B. Gay, R. H. Klauder.

JOHN A. ROEBLING'S SONS COMPANY had a full contingent at the meeting, inclusive of F. W. Harrington, D. F. Ivins, G. C. Bailey, W. H. Slingluff, A. B. Conover, E. P. Bartlett.

MANHATTAN ELECTRICAL SUPPLY COMPANY, of New York City, were by no means forgotten or overlooked, thanks to the assiduous efforts of Messrs. J. W. McDowell, F. M. Pierce and A. J. Anderson.

BAKER & Co., the platinum refiners and dealers, of Newark, N. J., were represented by their ever-popular and always-amiable principal, Mr. C. O. Baker, Jr., master of transportation for the association, and Mr. J. J. Lowthian.

STANLEY ELECTRIC MANUFACTURING COMPANY occupied handsome parlors and were represented by Messrs. Ray D. Lillibridge, E. L. Barr, V. W. Bergenthal, L. Etheridge, D. W. Dunn, M. C. Canfield, J. W. Chambers, G. W. Andress.

CROCKER-WHEELER ELECTRIC COMPANY were represented by Messrs. Putnam A. Bates and C. W. Startsman, both from the Ampere (N. J.) factories. Mr. Julian Roe, of Chicago, was also in active attendance with Mr. F. G. Whipple.

MR. G. F. PORTER, ex-secretary of the association, was warmly welcomed for his own sake by hosts of old friends, and was heartily congratulated on his recent connection with that vigorous and promising young concern, the Atlantic Insulated Wire & Cable Company. While in Chicago Mr. Porter had the satisfaction of securing a very substantial order, and was able to develop a large amount of new trade.

THE WAGNER ELECTRIC COMPANY was ably represented by R. G. Russel, the assistant manager of sales, who, after an absence of several years, has returned to the fold; also by G. E. Foster, of Chicago, district manager. The well-known product of this company was exemplified by a 1-hp and one 4-hp single-phase self-starting motors, also a 3-kw type F ammeter. A new vertical edgewise illuminated dial switchboard voltmeter was also on exhibition.

ELECTRICAL ENGINEERS AND CONTRACTORS were out in force, many of the leaders in the profession and industry being present. Among them may be mentioned President J. G. White, of the J. G. White Company; F. W. Sargent, consulting engineer of the Chicago Edison and other companies; Prof. W. E. Goldsborough, of the St. Louis Exposition Department of Electricity; D. Carl Henry, the Henry Electric Light Company, of Denver; Louis B. Marks, Prof. Morgan Brooks, J. K. Soden, F. S. Hickok, A. M. Barron, L. A. Briggs, W. D. Ball, W. J. Warder, Joseph Bijur, Foree Bain, Bion J. Arnold.

MISCELLANEOUS CONCERNS may be enumerated as follows: E. C. Lindsay, W. W. Lindsay & Co., Philadelphia; S. A. Douglas, American Vitrified Conduit Company; A. R. Battey, Pittsburg Sewer Pipe & Conduit Company; G. B. Davis, Standard Chemical Company; W. C. Bryant, Bryant Electric Company, of Bridgeport, Conn.; C. H. Macdonald, J. A. & W. Bird Co.; J. A. Vaughan, Carleton Chase Electric Company, of New York; A. A. Tibbe, Tibbe Electric Company, Washington, Mo.; R. Link, Keuffel & Esser Co.; J. C. Young, American District Steam Company; C. P. Hill, Doubleday-Hill Electric Company; W. S. Arnold, Arnold & Brownell Company; E. H. Noyes, Pittsburg Reduction Company; A. D. Wyckoff, Ball & Wood Company; C. F. Ziegler, Reynolds Electric Flasher Company; C. B. Colley, American Can Company; L. G. Le Bourveau, T. H. Bullock & Co.; W. F. S. Lake, Buffalo Forge Company; F. L. Collins, Illinois Steel Company; W. J. Best, Green Fuel Economizer Company; W. L. Goddard, McCormick Twine Works; E. H. Hammond, American Electrical Works, of Providence, R. I.; O. P. Cone, Hawks Electric Company.

THE WESTERN ELECTRIC COMPANY had a series arc light equipment in operation in the engine room of the Auditorium Annex. The lamps installed in front of both hotels and in the engine room formed a part of this equipment. The local exhibit was in charge of Messrs. W. S. Hine and L. G. Basset. A large number of representatives looked after the interests of the company. The apparatus department was represented by Albert Tucker, in charge of the display; Prof. W. L. Stockton, C. A. S. Howlett, H. B. Squire and C. W. Cobb, of Cleveland and Detroit. The supply department was in charge of C. E. Scribner, general supply and sales manager, as well as E. W. Rockefeller, of New York; P. T. Ackerson, S. Reed Faris, George Lounsberry, C. H. Talmadge and R. M. Field, of Detroit. The Chicago supply department was represented by L. F. Milner, A. L. Brown, P. H. Aaron and William Devine. C. D. Crandall, general manager, and F. K. Kretschmar, advertising manager, were also present. The engineering department was represented by C. Wiler. W. T. Hessel, of the Standard Electric Company, of Cincinnati, which is affiliated with the Western Electric Company, also was in attendance at the convention. A miscellaneous line of apparatus was shown in one of the parlors on the second floor. Here were exhibited samples of arc lamps, American transformers, fan motors, "Sunbeam" incandescent lamps, and a complete sample line of circuit-breakers and switches. A folder in the shape of a postal card, which was distributed, called attention to the arc light equipment at the Annex, and also showed one of their series alternating arc lamps.

THE DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, Ind., in one of the parlors on the second floor, made a very complete display of the Duncan wattmeter. It was in charge of Thomas Duncan, vice-president and general manager. W. J. Flanning, of the Electrical Material Company, of Baltimore, who is the Eastern agent, was also in attendance, as well as C. H. Norwoods, of Chicago. As is well known, the Duncan wattmeter is a commutating meter for both alternating and direct currents, and possesses a great many up-to-date features which make a meter of especial value to central stations. The great accuracy of the meter on light loads was forcibly illustrated by the ease with which one of the meters started on the low end of a Hylo lamp, the load being less than 1 per cent. of its rated capacity. This also illustrated the readiness with which the meter starts and stops when a large load is thrown on and off respectively. The various other points which make this meter of especial value are the accessibility to all of the parts by the mere removal of four screws, the dust and insect-proof character of the meter, the ease with which the revolving element can be removed for repair and inspection without taking the meter apart, and at the same time without altering the original calibration; and the specially insulated coils. An important feature is the direct reading dial used for all sizes, which readily permits the reading of the meter after installation in almost any position. These are manufactured for all voltages and sizes, from 2½ to 2,500 amp. A high-torque induction meter will be ready in about 60 days, which of course will be especially adapted for alternating circuits. Some very catchy advertising matter was distributed.

NATIONAL INDIA RUBBER COMPANY were represented by Mr. P. F. Lyons.

BENJAMIN ELECTRIC MANUFACTURING COMPANY exhibited a line of the Benjamin wireless clusters.

STANDARD PAINT COMPANY sent Messrs. J. C. Shainwald and E. R. Willard to look after the welfare of P. & B.

THE TRIUMPH ELECTRIC COMPANY, of Cincinnati, was represented, as usual, by W. H. Jacob, the sales manager.

NEW YORK SAFETY STEAM.—The interests of the New York Safety Steam Company were looked after by Mr. Milton Thomas, of the Chicago office.

GEORGE L. SAYLES, representing the Sterling Electric Manufacturing Company, of Warren, Ohio, made quite a showing with the Sterling Special incandescent lamp.

F. A. CHURCHILL, JR. represented W. N. Matthews & Bro., of St. Louis, who have the exclusive agency for the "Knocker" Boiler Cleaner and the Stombaugh anchors.

MR. W. H. PORTER, Western sales manager of the Alphaduct Manufacturing Company, made quite a hit with the delegates by distributing pipes made from their fire-proof conduit.

SPRAGUE ELECTRIC.—Mr. Alex Henderson, of the Conduit department, was present in behalf of the Sprague Electric Company. With him was associated Mr. Kittle, of the Chicago office.

THE NATIONAL X-RAY REFLECTOR COMPANY, of which A. L. Moore is the secretary and treasurer, and E. L. Haines general manager, showed a line of sterling silver-plated glass reflectors.

THE DIEHL MANUFACTURING COMPANY, Elizabeth, N. J., was represented by Mr. B. C. Kenyon, and had a display of its newest models in fan motors and deflector in the lobby of the Auditorium.

MR. MORTIMER NORDEN, of New York, looked after the interests of the Norden-Bittner Electric Company and the Electric Carriage Call Company, whose specialties in the lighting field were energetically advocated.

A. P. HOPKINS & COMPANY, of Escanaba, Mich., dealers in railway ties, poles and posts, were represented by M. Hopkins, vice-president. Although the company had a parlor on the sixth floor, no attempt was made to make an exhibit.

CENTRAL ELECTRIC COMPANY, of Chicago, were out in force, and Manager Charles E. Brown was particularly in evidence throughout the convention, extending all hospitalities of the city to the patrons of Okonite and the other C. E. specialties and agencies.

ECONOMICAL ELECTRIC LAMP.—A novel display was made on the first floor of the Auditorium by the Economical Electric Lamp Company, New York, to show off the merits of its "turn down" lamp. This attracted a good deal of notice and was in charge of Mr. M. Lobenthal.

MR. A. R. BATLEY, an old-time clay conduit man, who has sold the material, it is said, in every country in the world except China and Japan, places he hopes soon to visit, was present in the interests of the Pittsburg Sewer Pipe & Conduit Company, of Pittsburg, Kan., as general manager. He had a neat exhibit of two and four-duct conduit, etc.

THE CROUSE-HINDS ELECTRIC COMPANY made an interesting showing with their "Norbitt" and other specialties. Mr. Crouse and Mr. Hawkins, of the New York office in charge. A handsome souvenir in the shape of a pocket mirror in a neat leather case was distributed by the company. Other representatives were Messrs. F. F. Skeel, R. B. Kent and F. E. Hardin.

THE DALE COMPANY, New York had an interesting exhibit of specialties and Mr. John Dale, president, met a host of Western friends, who hastened to congratulate him upon the completion of the new building in New York City, into which the company has just moved. The Dale lighting specialties and standard goods have a well-established reputation now throughout the electric light and power industry.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, as usual, was represented by a large contingent, the following gentlemen being present: N. C. Cotabish, the sales manager, and F. W. Wilkins; A. D. Spear, F. H. Murray, F. C. Park, T. H. McDowell, F. J. Aylsela, A. V. Ward, A. G. Henry, A. C. Carrier, Wallace O'Connor. The Columbia carbons being so well known, those present contented themselves with renewing old acquaintance.

THE GREGORY ELECTRIC COMPANY were represented by A. L. Kuehmstedt, vice-president; George M. Ellis, secretary, and R. H. Watson, of the sales department. As the company is very busy looking after its business, which is quite extensive and of a large volume at the present time, it was not possible to make any exhibit at the convention. The company, however, reports that quite a number of the delegates called at its offices incidentally seeing the work which is being done at the shops.

ELECTRICAL WORLD AND ENGINEER received many congratulations on its "high water mark" issue of 220 pages, embracing first practical data as to the Curtis steam turbine; articles on the Chicago Edison and Commonwealth Companies; illustrated articles also on several smaller Western plants of interest, and a vast amount of general electric lighting material. The journal was represented by Messrs. J. M. Wakeman, J. V. S. Church and G. W. Elliott, of the business staff, and Messrs. T. C. Martin, J. R. Cravath, R. E. Sack and C. W. Whitney, of the editorial staff.

THE STANDARD ELECTRICAL MANUFACTURING COMPANY, of Niles, Ohio, had on exhibit a complete line of candelabra and decorative lamps. A special feature of the exhibit was the Star incandescent lamp, which consists of a star shade of any color, either fluted or plain, in combination with an incandescent lamp. The company, of course, manufactures a complete line of incandescent lamps of 50, 110 and 220 volts, and of any candle-power and size desired. J. P. Gilbert, secretary and treasurer, as well as H. H. Albert and John Rice, salesmen, represented the company.

BRYAN-MARSH COMPANY.—The interests of the Bryan-Marsh Company were looked after by George C. Keech, general manager, and a full representation of the sales department, which included L. D. Sawyer, manager of the Minneapolis (Minn.) branch office; E. H. Haughton, manager of the Cincinnati branch; J. L. Barnard, salesman, Minneapolis and Wisconsin district; A. G. Bowers, Iowa salesman; J. S. Corby, salesman Illinois and Missouri, and W. J. Behn, salesman for Michigan. As the product of the Bryan-Marsh Company is so well known, no exhibit was made, although the various representatives of the company were in touch with the delegates to the convention.

THE VALENTINE-CLARK COMPANY, of Chicago, because of its inability to show its product, which consists of Michigan, Wisconsin and Western cedars for electric light, telephone and railroad work, contented itself with a display of photographs showing the various yards of the company, which are located at Pinconning, Mich., and Green Bay, New London and Prentice, Wis. The company appreciates the fact that a readily available supply is of great importance, and for that reason the Washington cedar poles are handled principally through the Wisconsin yards, from which they can be obtained at short notice. Mr. E. L. Clark, the secretary and treasurer, looked after the company's interests, as well as F. L. McGillan, the traveling superintendent, and J. A. Greenwood.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY did not make any exhibit, its product being well known to all central station men. The bulletin which was issued during the convention by Mr. Bolles was well appreciated, and went to fill a popular demand, as was evidenced by the rapidity with which each issue was exhausted. Mr. Robert T. Lozier, the second vice-president and general sales manager was ably assisted by F. G. Bolles, assistant general manager of the sales department, and George B. Foster, the Chicago district sales manager. The charms which were presented to visitors at their headquarters, as has been the case at past conventions, bore a representation of a generator and were much in evidence. Each delegate registering was also given a white button badge by the company to correspond with his number in the Bullock bulletin.

H. W. JOHNS-MANVILLE COMPANY, of New York, made a very elaborate and interesting exhibit of its well-known Sachs "Noark" enclosed fuse protective devices, at its parlors, No. 230 Auditorium Hotel. Particular interest was exhibited by those in attendance in the new large capacity service switch and fuse boxes, which have recently been developed as large as 600 amp.; also single and double-branch blocks, in three sizes, up to and including 100 amp.—two and three poles. These are very compact in their construction, and have many advantages. A line of high-potential strain insulators, guaranteed to stand 5,000 volts, and having a braking strain of 6,000 pounds, were also shown. A number of orders have been taken for immediate delivery. A number of other specialties of the company's manufacture were exhibited, and examined by the visitors, with considerable interest. J. W. Perry, manager of the electrical department from New York, was in attendance, and was assisted by S. H. Finney, manager of the electrical department of the Chicago office.

F. H. GILMORE expounded the virtues of the A. Sorge, Jr., & Co.'s system of water purification.

THE PEERLESS ELECTRIC COMPANY, of Warren, Ohio, was well taken care of by H. B. Ramey.

E. A. RUMMLER, of Rummler & Rummler, solicitor of patents at Chicago, was a visitor at the meetings.

E. A. LINDSLEY, of Lindsley Bros. Co., of Chicago, talked poles to all visitors, as did also J. Alex. Navarre.

M. S. WALKER, of the F. Bissell Co., of Toledo, Ohio, enlightened all present on the value of the Nernst lamp.

THOS. H. BULLOCK and H. H. Albert represented the Standard Electric Manufacturing Company, of Niles, Ohio.

J. HARRY YOST and Frank H. Chapman represented the Yost Electric Manufacturing Company, of Toledo, Ohio.

THE INTERESTS of the Central Station Improvement Company, of Chicago, were well taken care of by F. R. Jenkins.

THE FULLER COMPANY, of Detroit, was brought to the attention of all visitors in an unassuming manner by R. Fuller.

C. R. KREIDER, of Kohler Bros., the consulting engineer of Chicago, managed to consult a great many of the delegates in the interest of his company.

F. N. JEWETT, in his usual affable manner, did not fail to impress upon the delegates the superiority of the Evans-Almirall system of central station heating.

BUCKEYE ELECTRIC COMPANY.—The interests of the Buckeye Electric Company, were looked after by W. R. Bonham, A. J. Schrum, J. M. Corke and W. K. Eyre.

THE NORTHERN ELECTRIC MANUFACTURING COMPANY, through the efforts of G. L. Stagg and Herbert Marks, informed the public of the merits of its apparatus.

THE GUARANTEE ELECTRIC COMPANY, of Chicago, was well represented by Charles E. Gregory, its president; Edwin R. Rockwell, the secretary, and E. H. Frank.

THE DEARBORN DRUG & CHEMICAL WORKS, of Chicago, as usual made its presence felt through the efforts of W. H. Edgar, its president. It distributed an amusing puzzle.

PORTER & BERG, who make a specialty of "I. T. E" circuit-breakers and Keystone instruments, and also handle a general line of supplies, were represented at the convention by J. L. Porter, the president, and E. R. Mason, the vice-president.

MR. C. A. BENTON was present in the interests of the electric elevators of the Marine Engine & Machine Company, now on the circuits of many plants. Incidentally also he was able to escort many friends to the offices of the Pyle-National Electric Headlight Company, where one of the novelties was an able-bodied railway car lit throughout from tail light to headlight with the Commercial Acetylene Company's safety storage system of acetylene gas, stored in acetone. This proved very interesting to electric lighting men, so many of whom are now operating gas works also.

ILLINOIS ELECTRIC COMPANY.—The interests of the Illinois Electric Company, of Chicago, were well taken care of by Francis Edward Healy, president; Carl Keith, treasurer, and T. K. Cushing, secretary. D. Newman and C. J. Litscher, representing the sales department, were in charge of the exhibit. This included, in addition to the regular line of supplies, the transformers and fan motors of the Peerless Electric Company, the lamp of the Warren Electric & Specialty Company, the fans, motors and lightning arresters of the Westinghouse Electric & Manufacturing Company, the C. L. Pierce, Jr., line of construction material specialties, the Acme dial switch, Duncan direct-current meters, and a German lamp known as the "Sunshine," which is being introduced in this market.

THE FORT WAYNE ELECTRIC COMPANY representatives managed to keep quite comfortable by means of a new revolving fan motor, which was suspended from one of the fixtures in the room. This is remarkable for its low consumption, as it takes but 17 watts for operation on direct-current circuits, which, of course, is about one-third of the energy consumed by an ordinary 16-cp lamp. It is sent out with a T.-H. adapter, and as its weight is but 3¼ pounds it can be readily adapted for many uses; in fact, a request has been received for providing the fan with a handle so that it can be readily used by barbers. The company did not attempt to make any extensive display, as its product is quite well known. The exhibit was in charge of F. S. Hunting, the sales manager and treasurer of the company, and he was ably supported by W. S. Goll, the manager of the Chicago office; T. J. Ryan, of the Cincinnati office, and W. C. Knight, of St. Louis. J. H. Raymond, Frank McMaster and I. S. Jackson, of the sales department of the Chicago office, were also in attendance, as also A. A. Serva, the assistant sales manager at Fort Wayne, and E. A. Wagner, of the sales department.

ELBLIGHT.—The Elblight Company of America was represented by Mr. Russell Spaulding, president; Mr. E. H. Abadie, general manager, both from New York; J. Allen Haines, Western manager. The South Parlor was handsomely decorated with Elblight cable and miniature lamps of many colors festooned and all covered with a profusion of greens. Portieres of Elblight cable and lamps covered with green foliage were in the doorways and lent to the reception to the delegates, ladies and members, a festive appearance in sharp contrast with the rest of the hotel. This same parlor was used as the headquarters of the General Electric Company and the decorations were so attractive they were left in place during the entire convention. The company had headquarters in suite 601-2, where they exhibited some decorations consisting of portieres and flags, together with a large collection of photographs, showing the many important and artistic decorations made throughout the country with the Elblight system. They also exhibited an aquarium with Elblight cable and a lamp burning under water. The lamp shown had previously been burning continuously under water for over three months without deterioration. The Elblight Company are to be congratulated upon the universal interest created by their brilliant and excellent display.

WESTINGHOUSE ELECTRIC.—Aside from occupying commodious headquarters, it may be said that the entire hotel was the exhibit of the Westinghouse Electric Manufacturing Company, for the reason that the Auditorium Hotel Company have in use over 38,000 Sawyer-Man incandescent lamps. The generating room is located in the Annex of the hotel, and furnishes light and power for the two hotels and the theatre. It is the largest isolated plant in the West and includes a 500-kw Westinghouse engine type direct-current generator. A special panel board designed to show the operation of various types of Westinghouse precision instruments was also to be seen in the dynamo room and attracted considerable attention. These included the synchroscope, the power factor meter, various wattmeters and voltmeters, and a frequency meter. The company had a large staff in attendance at the convention, including F. H. Taylor, vice-president; C. F. Scott, W. M. Probasco, E. W. T. Gray, A. L. Millard, E. J. Burke, A. E. Ransom, A. M. Miller, J. J. Gibson, P. S. Gibson, J. S. Peck, N. S. Braden, A. Hartwell, C. S. Cook, A. Huntington, R. E. Schanlin, R. N. C. Barnes, W. H. Whiteside, F. N. Kollock, R. L. Rathbone, S. H. Anderson, M. P. Randolph, S. B. Storer, W. D. McDonald, E. Dryer, N. Stewart, G. B. Dusinberre, H. P. Davis, W. C. Armstrong, W. Karapetoff, W. E. Foreman, T. P. Gaylord, G. W. Pulver, F. S. Smith, C. A. Ross, T. H. B. Whipple, H. C. Marsh.

HYLO.—A flash sign in the main lobby, which attracted universal attention and favorable comment was that of the Phelps Company, of Detroit, Mich., of which Mr. Alex Dow is the president. W. E. Phelps, vice-president; W. J. Phelps, secretary, and J. Wylie Phelps, sales manager, were in attendance at the convention, and explained the interesting features and the various makes of Hylo lamps which are being manufactured by this company. In addition to their regular lamp, a long-distance Hylo operated by means of a pendant switch, which obviates the necessity of a wall switch, and the new "Pull-string" lamp were shown. The valuable features possessed by this lamp are well known, although it may be well to mention the fact that the increased cost of the lamp is more than compensated for by the increased life. The Hylo self-flashing sign lamps are quite a novelty, as was attested by the interest the sign aroused. This is so different from anything that has been put on the market that it will prove quite a factor in the sign business. In fact, any sign which has lost its usefulness can be rehabilitated and rejuvenated by simply changing lamps. The objection that the information which the sign is to convey to the public at large is entirely lost for several seconds at a time, and as a consequence does not fulfil its purpose as well as might be, is overcome by the new self-flashing sign lamp. The entire outline of the letters is always visible, thus ever presenting the object of their mission; and because of the fantastic irregularity with which the lamps light up and the kaleidoscopic effect produced thereby, the sign not only attracts but holds the attention of all passersby. A valuable feature is the long life of the lamp and the saving in current, also the convenience which results from the use of the lamp, as it does away with the maintenance of switching apparatus.

"FLEXDUCT" had both H. G. Osburn and C. E. Corrigan to sing its praises.

THE MERKLE ELECTRIC COMPANY, of St. Louis, was represented by N. W. Ewing and Milton Mill.

THE CHICAGO INSULATED WIRE COMPANY appeared in the persons of William M. Smith and T. C. Turlay.

THE MCCOMBER-WHYTE ROPE COMPANY, of Chicago, was represented by George Whyte and A. McComber.

HART MANUFACTURING COMPANY, Hartford, Conn., had an extensive exhibit of their switches on the main floor.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, made its presence felt through R. S. Wakefield and L. F. Philo.

M. B. AUSTIN & CO.—H. T. Tate, A. Mementa and A. H. Friend were on hand in the interests of M. B. Austin & Co., of Chicago.

J. M. DENNISTON, of Chicago, well known to many electrical men in the West, represented Joseph T. Ryerson & Son, iron merchants and special agents.

FAIRBANKS, MORSE & CO.—The interests of Fairbanks, Morse & Co., of Beloit, Wis., were taken care of by L. J. Osborne and William A. Moore, of Chicago.

MCROY CLAY WORKS.—E. F. Kirkpatrick, who never misses a convention, was on hand to tell the delegates with bated breath about the marvelous product of the McRoy Clay Works.

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, the well-known manufacturers of rheostats, was ably represented by Mr. Hammer himself, A. P. Munning and W. H. Beattys, Jr.

HABIRSHAW WIRES and cables were not forgotten, Mr. J. B. Olsen, sales manager, being on hand from the New York office. Regret was expressed on every hand at the absence of Dr. Habirshaw.

EUGENE MUNSELL & CO., of St. Louis, were well represented and considerable attention was attracted by a fine specimen of sheet mica hung over the main stairway in the Auditorium like a framed picture.

MR. W. B. JACKSON, of the consulting engineering firm of D. C. & W. B. Jackson, Madison, Wis., was in attendance. It was regretted that Prof. D. C. Jackson could not attend, until the convention was partly over.

GEORGE CUTTER.—No convention is ever complete without the presence of George Cutter, of Chicago, and this one was no exception. He was ably assisted by Albert Scheible, secretary of the George Cutter Company.

THE CONSOLIDATED ENGINE STOP COMPANY, through their representative, Mr. F. S. Palmer, showed their various devices for instantaneous control and stoppage of engines, etc., and the devices attracted considerable attention.

GENERAL INCANDESCENT ARC LIGHT COMPANY, of New York City, made an excellent display and were represented by Mr. Martin J. Insull, Mr. H. P. Ball and Mr. J. H. Hallberg, the last of whom contributed an able paper to the programme.

THE SHEDD ELECTRIC MANUFACTURING COMPANY added to the comfort of the delegates through the efforts of Mr. Peterson by placing several of their oscillating fans on the main floor. They were a great boon during the rather stifling weather of the week.

STANDARD UNDERGROUND CABLE COMPANY had headquarters in parlor 126 and had a splendid corps of representatives, including Mr. C. J. Marsh, of New York; the veteran J. R. Wiley, of Chicago; E. J. Pietzcker and W. M. Rogers, the other two local members; T. E. Hughes, of Philadelphia, and A. A. Anderson. Mr. Wiley was unremitting in his thoughtful attentions to visitors from out of the city.

THE NERNST LAMP COMPANY was represented at the convention by Messrs. A. E. Fleming, Chicago; G. E. Bennett, Chicago; F. H. Carpenter, Chicago; Calvin W. Rice, Pittsburg; R. H. Lee, Jr., Pittsburg; M. W. Hanks, Pittsburg. It is needless to say that the Nernst lamp was one of the leading topics of discussion at the convention, among central station and supply men alike. Going to and coming from the convention, those who passed through Detroit were greatly interested in the depot lighting done there by Mr. Alex. Dow, who is himself very well pleased with the result. The long platform thus lit shows up remarkably well in comparison with an adjoining arc lit platform; and the depot staff appear to like the new light immensely.

GEST CONDUIT MATERIALS.—Mr. G. M. Gest, of Cincinnati, the expert electrical subway contractor, who has come so rapidly to the front in subway construction in America, had a most interesting exhibit in the Auditorium Annex, in charge of Messrs. F. C. Mott and W. T. Jackson—the latter a newcomer lately on the *Cincinnati Enquirer*, who soon made himself a favorite and justified Mr. Gest's selection as representative of these important interests. Four distinct and valuable specialties were exhibited, namely the bracket frame, the mandrel, the trap valves and the smooth terminals. All these have been designed and invented to meet difficulties or drawbacks in conduit work, and Mr. Gest has proved himself a skillful worker in this field, whose conditions are so onerous and trying. But it is in thus solving the problems that he has created a large and growing business peculiarly his own.

AMONG THOSE PRESENT at the convention, but not making any exhibits were the following: M. W. Thomas, of the Michigan Electric Company, of Detroit, Mich.; L. F. Mahler, western sales manager of the De Laval Steam Turbine Company; D. C. Hemingray Glass Company, of Covington, Ky.; R. J. Randolph, of the Bunny Company, of Milwaukee; W. R. Mason, general manager of the Mechanical Boiler Cleaner Company; Willard Fuller, of the Acme Switch Company, of Cleveland, Ohio; R. B. Corey, of the Columbia Incandescent Lamp Company, of St. Louis; E. A. Jenkins, of the H. T. Paiste Company; E. E. Woodward, the Woodward Governor Company, of Rockford, Ill.; Enos Bookwalter, representing A. L. Ide & Sons; John H. Fowler, of the Fowler-Jacobs Company, of Chicago; Wm. Coale, of the Sterling Electric Manufacturing Company, of Warren, Ohio; T. H. Rodman, of the Milwaukee Electric Company; V. G. Apple, of the Dayton (Ohio) Electric Manufacturing Company; J. B. Estabrook, of the Colonial Electric Company, Ravenna, Ohio; J. S. Crider, secretary of the Washington Carbon Company; G. G. Luthy, of the Royal Electric Company, of Peoria, Ill.; A. M. Searles, the Chicago representative of the Warren Electric Manufacturing Company, and Charles Messer, president of the Dearborn Electric Company.

HOLOPHANE GLASS COMPANY seemed to score more heavily than any one else at the convention, both by reason of its handsome souvenirs and because of its interesting educational exhibit of illumination effects. Mr. Van Rensselaer Lansingh, the illuminating engineer of Chicago, was in charge, and was aided by Mr. H. W. Lauritzen. A large room was occupied filled with a complete line of Holophane shades and globes—over 150 styles of globes, shades, etc. By means of two special dark rooms, demonstrations were made of the value of the holophane principle. In each case a copy of ELECTRICAL WORLD AND ENGINEER was laid on the floor open at the ad of the company. In test No. 1 two 32s and one 16 cp bare lamps were shown versus one 16-cp with a 5-in. Pagoda reflector. In test No. 2 three 16-cp lamps in a straw opalescent hemisphere were shown versus one 16-cp in a Holophane hemisphere. The contrasts gained were nothing short of sensational, and every visitor was convinced readily of the value of the holophane globes and shades for specific concentration or direction of the light, with resultant economy. The "prize package" was a large square cardboard box in which were nested three styles of holophane globes and shades—a most appropriate but at the same time a very expensive souvenir for a convention of nearly 1,000 people. But it was good advertising.

AMONG OTHERS IN ATTENDANCE at the convention were noted the following-named gentlemen: C. J. Kenny, Consumers' Carbon Company, Lancaster, Ohio; Col. J. H. Shay, Chicago Belting Company, Chicago; F. L. Merrill, Standard Railway Materials Company, Chicago; C. H. Wilmerding, Chicago Sectional Electric Underground Company, Chicago; John P. Dales, American Insulated Wire & Cable Company, Chicago; W. W. Merrill, Chicago Fuse Wire & Manufacturing Company, Chicago; T. O. Moloney, Moloney Electric Company, St. Louis, Mo.; W. J. Cooke, McGuire Manufacturing Company, Chicago; A. Lester Thayer, Browning Manufacturing Company, Chicago; H. A. Tremaine, Crouse-Tremaine Company, Chicago; A. Thurlby, Morriston File & Lock Company, Chicago; William Goltz, Goltz Engineering Company, Chicago; David Evans, Field-Evans Iron Company, Chicago; F. S. McCoy, Adams-McCoy Electric Company, Muscatine, Iowa; G. H. Barbour, De Forest Wireless Telegraph Company, Chicago; J. A. Johnson, Kuhlman Electric Company, Elkhart, Ind.; Edmund Dickey, Dickey-Sutton Carbon Company, Lancaster, Ohio; A. H. Charles Dalley, Underfeed Stoker Company of America, Chicago; R. V. Parkinson, Illinois Maintenance Company, Chicago; A. B. Rich, L. Klein, Chicago; Al Smith, Keelyn & Smith, Milwaukee, Wis.; H. G. Landis, Electric Supply & Construction Company, Wichita, Kan.; H. L. Davis, Home Rubber Company, Chicago; Frank H. Pond, Chase Engine & Manufacturing Company, Chicago.

OKONITE interests were looked after by George T. Manson, New York.

CHASE SHAWMUT COMPANY, Boston, had Harry P. Moore in charge of their exhibit.

MR. SEARS B. CONDIT, JR., of Boston, was busy explaining the merits of his various electrical specialties.

AMERICAN CIRCULAR LOOM COMPANY had H. B. Kirkland, R. B. Corey and Thomas G. Grier present to speak the word.

STANDARD VITRIFIED CONDUIT.—Here, there and everywhere was Captain B. S. Barnard talking and displaying the product of the Standard Vitrified Conduit Company. He found a few minutes' time to spare to get away from the Auditorium and take an order for about $10,000 in the city.

MR. J. S. MAURER looked after the interests of Hart & Company, of Chicago, of which firm he is manager, and the Marshall Sanders Company, of Boston. He was assisted in displaying the Hart goods by E. Kearns. Considerable attention was attracted by balloon signs to the Red Cross lubricant for commutators, a Hart product.

THE FOSTORIA INCANDESCENT LAMP COMPANY, of Fostoria, Ohio, occupied one of the rooms in the Auditorium, but made no exhibit Its representatives included H. H. Geary, sales manager; F. G. Kreatcher, Illinois and Missouri salesman; J. S. Maurer, Chicago agent, and C. J. Wells, salesman for the Ohio and Michigan territory.

THE MILLER ANCHOR COMPANY, of Norwalk, Ohio, displayed several types of Miller earth and rock anchors, and the augers used for setting them. G. H. Miller, the proprietor of the company, was on hand explaining the merits of his devices and stated that he had been meeting with great success in sales to telephone, electric light and street railway companies throughout the country.

PHŒNIX GLASS COMPANY.—Mr. T. H. Howard, son of Mr. Andrew Howard, president of the Phœnix Glass Company, was attending his first electric light convention and found it a very interesting and amusing experience. He was accompanied by the veteran, Mr. A. H. Patterson, who has forgotten the exact number of conventions he has attended, but still shows up with the same keen zest as of old.

AMERICAN PUSH BUTTON TELEPHONE COMPANY., of 136 Liberty Street, New York City, had a unique display, consisting of a complete telephone outfit, including telephones connected to 200 ft. of wire and batteries, etc., all contained in a small grip. The company was represented by the manager, Mr. W. V. Sweeten, who secured an order for 500 telephone equipments for Japan while at the convention.

REYNOLDS ELECTRIC FLASHER COMPANY, of Chicago, for whom Mr. C. F. Ziegler appeared, had one flasher operating a sign of four large letters for the Electric Appliance Company on the sixth floor, and another sign operating a "Sunbeam" lamp letter sign at the Western Electric Company's headquarters on the first floor. As this sign was not wired for a flasher, Mr. Ziegler was compelled to control the entire seven letters, containing 84 lamps, with one switch only; and it stood this extreme load remarkably well. The flashers naturally excited attention and aroused much favorable comment.

FRANCES BIEDLER & COMPANY, of Chicago, producers and wholesalers of Michigan and Idaho cedar poles, occupied one of the rooms in the Auditorium. M. D. Cross, manager of the cedar pole department of the firm, looked out for the company's interests and was assisted by Roy L. Jones and F. F. Gunninger, corporation salesman. Biedler & Company have recently branched out strongly in their Idaho cedar pole product, and they received many compliments for their neat invitations, sent out to their customers and friends before the convention, which contained sprigs of Michigan white cedar and Idaho red cedar. They distributed neat aluminum thermometers.

THE MONARCH ELECTRIC & WIRE COMPANY, manufacturer of Monarch brand weather-proof wire, and dealer in general electrical supplies and material, of Chicago, had an exhibit at the Auditorium. The company's weather-proof wire was shown in several sizes. This wire is said to be receiving favorable attention throughout the West, on account of its lasting qualities and other valuable features. In the way of supplies, the company showed several Westinghouse alternating-current fans, some Colonial direct-current fans, and some Flexduct and other standard material. C. A. Kuhlman and A. D. Gillespie were in attendance as representatives of the company and H. Schwab, secretary, was also an occasional visitor.

ROCKING GRATES.—The merits of the Martin anti-friction rocking grates were demonstrated by Secretary G. W. Tracy, of the Martin Grate Company, of Chicago. This grate is fitted to burn any kind of coal, but is said to be especially adapted for the slack and screenings of the soft coals. It is also said to have many other valuable features, which makes it adaptable and economical for central station use. One of the Martin grates was exhibited in room 214, and attention was called to it by a unique pamphlet entitled, "The Grate that Jack Built." Count Alexander Cavalli, well known to many Chicagoans, is a representative of the Martin Grate Company, and he was in constant attendance at the convention, where he renewed many friendships.

THE BANNER ELECTRIC COMPANY, of Youngstown, Ohio, made an interesting exhibit of its line of incandescent lamps. Of particular note was the company's four-coil, three-anchor, 220-volt lamps, which were shown in oval and round bulbs, and with frosted and clear glass. Other types of lamps shown included bung-hole lamps and those especially adaptable for sign and window lighting. The Banner goods were made especially evident about the convention rooms by "chirpers," which persistently called attention to the Youngstown products. The exhibit was in charge of N. L. Norris, general manager, and F. C. Kirchner, superintendent. They were assisted by R. T. Hamilton, J. E. Hart and E. N. Beach, traveling salesmen for the company.

NATIONAL ELECTRIC COMPANY.—This convention was the first one at which the new National Electric Company, of Milwaukee, appeared under that official name. This company, as has already been announced in these columns, is successor of the Christensen Engineering Company, and is continuing the manufacture of the latter company's excellent electrical and air brake products. The company made no exhibit of apparatus, but had in its room several excellent photographs of alternating and direct-current electrical machinery which it is now building in capacities up to 1,500 kw. The company was officially represented by F. L. Hutchinson, manager of sales department, of Milwaukee; Charles G. Burton, manager of the Chicago office of the company; Arthur Jones, Cook County sales agent, and W. L. Waters, chief engineer, and Charles D. Knight, engineer, of Milwaukee.

THE GENERAL ELECTRIC COMPANY occupied the large south parlor on the first floor of the Auditorium Hotel. Among those representing the company who attended the convention were Mr. J. R. Lovejoy, general manager lighting, railway and supply departments; Mr. B. E. Sunny, Western manager, Chicago; Mr. C. B. Davis, manager, Boston office; Mr. A. F. Giles, manager, Atlanta office; Mr. J. S. Anthony, acting manager, New York office; Mr. A. D. Page, manager incandescent lamp sales, Harrison, N. J.; Mr. C. D. Haskins, Mr. W. S. Moody, Mr. H. W. Hillman and Mr. P. D. Wagoner, of Schenectady, N. Y.; Mr. J. C. Calisch, Buffalo; Mr. George D. Rosenthal, St. Louis, and Mr. W. M. Deming, Cincinnati; Mr. E. H. Mullin, publication department. During the week Mr. W. L. R. Emmet, who has done such brilliant work at Schenectady on the Curtis turbine, came on accompanied by Mr. Gilbert, and participated most effectively in the most important part of the programme—the discussion of the Robb paper on the steam turbine.

ELECTRIC APPLIANCE COMPANY.—One of the most frequented and popular quarters in the Auditorium during the convention was that of the Electric Appliance Company, of Chicago, which occupied rooms 614 and 616. These rooms were continually filled with a host of delegates and visitors, who were royally entertained by I. A. Bennett, manager of sales department, and W. P. Upham, they being ably assisted by P. R. Boole and S. A. Rall and others of the Electric Appliance staff. President W. W. Low was also in frequent attendance and made his energetic personality felt. The exhibit of the Electric Appliance Company was shown individually by the different companies which it represents as sales agent in Chicago. The New York & Ohio Company, of Warren, Ohio, manufacturer of incandescent lamps, was represented by W. D. Packard. A full line of Guttmann wattmeters was shown by the Sangamo Electric Company, of Springfield, Ill., the special merits of these meters being ably demonstrated by R. C. Lamphere. J. G. Pomeroy displayed the well-known line of incandescent lamps manufactured by the Adams-Bagnall Company, of Cleveland. Another one of the Electric Appliance Company's exhibits was a quantity of commutator compound and soldering sticks manufactured by the Crescent Company, of Chicago, and displayed by James McGill.

W. N. MATTHEWS & BRO., of St. Louis, were represented at the convention by F. A. Churchill, Jr. A working exhibit was shown of the firm's steam scale knocker, which is a mechanical device that is said to be very efficient in removing scale from return tubular boilers by either steam or air. Mr. Churchill also called the attention of the visitors to the merits of the Stombaugh guy anchors.

THE ELECTRICAL EQUIPMENT COMPANY, one of the rising electrical contracting and engineering concerns, of Chicago, was represented at the convention by President J. W. Peterson, W. W. Kittleman, engineer and salesman, and A. W. Tobin. They were kept busy receiving congratulations on having recently secured a large contract for electric lighting and power machinery to be installed at Zion City, famed as the model city of John Alexander Dowie.

THE JEWELL ELECTRICAL INSTRUMENT COMPANY, of Chicago, had an interesting exhibit in the Auditorium. Edward W. Jewell, proprietor of the company, assisted by W. H. Huson, was in attendance to explain the distinguishing features of the Jewell meters. There was shown a complete line of central station instruments, including illuminated-dial voltmeters and ammeters, a switchboard with circuit-breaking instrument, battery-charging outfits, and standard switchboard and laboratory instruments.

FEDERAL ELECTRIC COMPANY.—One of the most noticeable and interesting exhibits to the central station men was that of the Federal Electric Company, of Chicago. This company, as is becoming quite well known, is the originator of a new type of electric sign, which is being installed extensively throughout the country. In room 636, the company showed a full line of electric signs, and James M. Gilchrist, manager, with the assistance of J. D. MacKenzie, was on hand to demonstrate the advantages of the porcelain-enamel metal feature. The company is just beginning to push a new type of sectional sign, in which each letter is mounted separately. These sign letters are not on the market as yet, but a sample of what will be the company's standard 16-inch letter was exhibited. This separate letter sign will be especially adapted to central station work, for the reason that when the sign is furnished to a customer, the letters may be used over again for another sign after his contract expires. Among the other types of signs exhibited were the regular panel signs, steel circular signs for brewery trade, and steel letter signs in one solid piece, these latter being distinct from the regular Federal sign, which has the lamps arranged around the edge, with the letters in white enamel. In the convention hall the company had a circular sign, on which was the monogram of the Association, while the entrance to the hall was designated by a panel sign of the Federal type. The company also had two of its signs on the parlor floor. A useful folder that was distributed to the delegates contained the programme of the convention, a map of the business district of Chicago, and information regarding the leading theatres, hotels, hack fare, etc.

Electric Vehicles in Boston District.

It is announced in Boston that the recent combination of electric lighting companies within a radius of 25 miles of the city will result in the development of the use of electric automobiles. Up to the present time, charging facilities have been very limited, but by the end of the coming summer it will be possible to charge an electric automobile not only at every large garage in the Boston district, but at electric light stations and even in livery stables, and arrangements are to be made whereby most of these places will be open 24 hours per day and every day in the year. It has been proposed to use coupon books like railroad mileages, which will be accepted in payment for current at any of the stations. There will be a few stables and lighting stations in the district which will not be open between midnight and 6 or 7 o'clock A. M., but the majority will be open all the time. In each station special facilities for automobile charging will be provided.

Vehicles may now be charged at all times at power stations in Brockton, Brookline, Cambridge, Gloucester, Lawrence, Lynn, Lowell, Malden, Medfield, Salem, Stoughton and Weymouth. Other charging points, most of them open for limited periods each day, are located at Arlington, Brockton, Fitchburg, Lawrence, Lowell and Lynn; and three in Boston open all the time.

About the middle of July additional charging stations will be opened in livery stables in Milton, Dedham, South Framingham, Natick, Winchester and Grove Holl, and in lighting stations in East Boston, Somerville, Woburn and Watertown. By August 1 additional charging stations will be located in Arlington, Canton, Chelsea, Chestnut Hill, Forest Hills, Needham, Newtonville and Stoneham.

Thus about 40 charging stations will be available in Eastern Massachusetts, each within a fair running distance of some other. There will probably be no charge less than 30 cents, but for large quantities of electrical charging energy the rate will be 10 cents per kw-hour.

It is expected that this extension of facilities will produce a large growth in the electric automobile business around Boston. The new stations will make it almost as easy for a man to use an electric carriage for business or pleasure as to hire a horse. The Edison Electric Illuminating Company, of Boston, has given orders for a special equipment of heavy electric trucks and lighter vehicles to replace the horses and wagons now used in the care and maintenance of its conduits, overhead circuits and lamps throughout the city and suburbs. These vehicles will be designed for special work in connection with hoisting poles, drawing cables through conduits, hauling apparatus and supplies from place to place, and later the company will put in service a light van for emergency repairs, capable of running 16 miles per hour, and also two trimmers' wagons for arc lamp maintenance.

The New Claypool Hotel in Indianapolis.

The new Claypool Hotel in Indianapolis, representing an investment of $1,400,000, has been opened to the public. The generating plant consists of three engine type generators built by the Jenney Electric Manufacturing Company, of Indianapolis, such machine having a nominal rating of 150 kw, and run at a speed of 200 r.p.m. These machines are of the latest design of the Jenney Company, and are of the six-pole construction. The details of brush-holder rigging are very complete; any one of the carbons on either set can be easily lifted from the commutator while the machine is in operation, and the tension on each set of brushes can be varied as desired, and the entire set can be lifted from commutator by means of a worm gear mechanism provided for each set of brushes.

In addition to the generating plant, the Jenney Company have also equipped numerous machines throughout the building with individual motors, being the motors attached to ice cream freezers, dish-washing machines, ice machine and crumbing machine. In applying the motors to these machines supports of special design have been made which make each equipment extremely compact and self-contained, there being no countershafts or jack shafts required in transmitting power from motor to its respective machine. The extensive laundry equipment is operated by means of a 20-hp Jenney universal motor driving to line shaft in the usual manner.

The wiring at the Claypool was done by the Sanborn-Marsh Electric Company, all the electric light and telephone wires being run in iron-armored conduit. The distribution for the electric lighting comprises 20 sets of feeders from the main switchboard in the basement which run to the centers of distribution throughout the building. The line loss and difference of potential is kept down to a minimum by this method. The tablet boards are made of slate and the cabinets of iron and the circuits are provided with jackknife switches and enclosed fuses.

There are more than 12,000 lights used in the installation and a special feature of the lighting of the large special rooms is that low-candle-power lamps are used and distributed in profusion, the result being an even and perfect distribution of the light, which serves to bring out the decoration and illumination of the building in a very satisfactory manner.

The telephone equipment consists of a central energy plant placed in the basement in a room especially designed for its use. On the first floor is a lamp switchboard for the accommodation of 400 telephones, which are placed in all of the sleeping rooms and departments of the building. An unusual feature of the telephone wiring is that all wires are run in iron conduits. It is said that this is one of very few buildings where the telephone wires are put in with the same care that the electric light wires are. It is expected that by this method the trouble in the line wiring will be reduced to a minimum.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Time money closed at 3½ per cent. for 60-day loans. The stock market was depressed and weak on continued liquidation and bearish pressure. The selling seemed to come from large interests, although there were no disturbing incidents in Wall Street circles, and the news regarding railroad and other properties continued mainly very favorable. Brooklyn Rapid Transit was the most active of the traction group, and was affected by heavy liquidation sales, due mainly to sympathy with the rest of the list. Amalgamated Copper was very active, and declined on heavy selling, from 64¼ to 57⅜, there being rumors of liquidation by interests which have lately been active in bulling this stock. Some of the high-priced industrial specialties, including General Electric, lost considerable ground on very small transactions, though this seemed to be due to the narrowness of the market and the absence of bids for such securities. The closing price of General Electric was 181, a net decline of 2¾ points. The extreme quotations for the week were 180 the lowest, and 184½ the highest, the sales aggregating 4,600 shares. One hundred shares of Westinghouse were sold at 191, which was the ruling price throughout the week, being a net decline of 4¼ points. Westinghouse rights closed at 5½—a decline of 1½ points. Brooklyn Rapid Transit fluctuated between 58¾ and 62½, closing at 59⅛, this being a net loss of 2⅝ points. Metropolitan Street Railway was quiet, and fluctuated within narrow limits, closing at 128⅛, which is a decline of ⅞. American Telephone and Telegraph suffered a net loss of 6¼ points on the week's transactions, closing at 153, which was the unvarying price throughout the week. Following are the closing quotations of June 2.

NEW YORK.

	May 28.	June 2		May 26.	June 2
American Tel. & Cable	75	75	General Electric	183¾	180⅝
American Tel. & Tel.	153	..	Hudson River Tel.	..	..
American Dist. Tel	29	29	Metropolitan St. Ry	129¾	128⅛
Brooklyn Rapid Transit	61⅝	58¼	N. E. Elec. Veh. Trns.	..	⅛
Commercial Cable	..	..	N. Y. & N. J. Tel.	..	..
Electric Boat	20	20	N. Y. E. V. T. Co.	6¼	5¼
Electric Boat pfd	39	38	Tel. & Tel. Co. Am	..	..
Electric Lead Reduction	1¼	1¼	Western Union Tel.	82¾	84¼
Electric Vehicle	8¼	8¼	Westinghouse com.	190	..
Electric Vehicle pfd	13½	14½	Westinghouse pfd.	190	185

BOSTON.

	May 26.	June 2		May 26.	June 2
American Tel. & Tel	154¼	151½	Western Tel. & Tel. pfd.	95	92*
Cumberland Telephone	..	..	Mexican Telephone	1¾	1¾
Edison Elec. Illum.	..	..	New England Telephone	136*	132
General Electric	..	255	Westinghouse	94	90
Western Tel. & Tel	17½	16*	Westinghouse pfd.	94	90

PHILADELPHIA.

	May 26.	June 2		May 26.	June 2
American Railways	..	..	Phila. Traction	96⅛	96⅛
Elec. Storage Battery	74*	64½	Phila. Electric	6¾	6¼
Elec. Storage Battery pfd.	74*	..	Pa. Electric Vehicle	..	..
Elec. Co. of America	8¼	8⅛	Pa. Electric Vehicle pfd	..	..

CHICAGO.

	May 26.	June 2		May 21.	June 2
Central Union Tel.	..	..	National Carbon pfd.	95	95
Chicago Edison	..	155	Northwest Elev. com.	..	..
Chicago City Ry	200½	200	Union Traction	3½	4⅛
Chicago Tel. Co.	..	140	Union Traction pfd.	32½	32⅛
National Carbon	23¾	23¾			

*Asked.

THE LATEST U. G. I. DEAL.—A dispatch from Detroit, of May 30, in regard to a matter already noted in these columns, says: A deal of great import to the properties of the American Light and Traction Company is pending, in which it is probable that the United Gas Improvement Company, of Philadelphia, will take over the following companies included in the former corporation on a ninety-nine year lease: Western Gas Company, of Milwaukee; St. Paul Gas Light Company, of St. Paul; Grand Rapids Gas Light Company, of Grand Rapids; St. Joseph Gas Company, of St. Joseph, Mo.; Madison Gas and Electric Company, of Madison, Wis.; Binghamton Gas Works Company, Binghamton, N. Y.; Southern Light and Traction Company, of San Antonio, Tex.; Consolidated Gas Company of New Jersey, of Long Branch, N. J. These are all in the group of McMillan companies, and the president of the American Light and Traction Company is Emerson McMillan, of New York. Manager Paul Doty, of the Detroit City Gas Company, has confirmed the statements in the above story.

NEW ENGLAND TELEPHONE.—The directors of the New England Telephone and Telegraph Company are expected to take action on the annual new stock issue. The growth of the company's business averaging about 15,000 new subscribers annually requires about $2,000,000 each year for new construction. The company has about 53,000 subscribers in Greater Boston, which compares with 44,969 subscribers June 1 last year, and 30,809 June 1, 1901. The subscribers in Greater Boston represent about 50 per cent. of the company's total subscribers. Last year the New England Telephone Company expended on plant and equipment $3,941,896 against $3,801,383 in 1901 and $3,153,501 in 1900. This year it is estimated that $4,000,000 will be spent for new construction and maintenance, divided as follows: for new construction, $1,800,000; for maintenance, $2,200,000. Last year 36,047 shares of new stock were issued on a basis of one new share for each five outstanding. In 1901, 25,774 shares were issued on a basis of one new share for each six held.

BIG TROLLEY MORTGAGE.—A chattel mortgage for $20,200,000, given by the new Public Service Corporation to the Fidelity Trust Company, was filed in the County Register's office at Newark, N. J., this week. The mortgage covers all the stock of the United Electric Company and the trolley companies turned over to the Public Service Corporation in accordance with the merger proposition. The number of shares of stock of each company enumerated is as follows: North Jersey Street Railway Company, 138,069; Jersey City, Hoboken and Paterson Railway Company, 200,000; Elizabeth, Plainfield and Central Railway Company, 29,950; Orange and Passaic Valley Railway Company, 89,019, and United Electric Company, 181,469. The mortgage was executed June 1, and was given to guarantee the payment of interest-bearing securities awarded to holders of these stocks.

CUYAHOGA TELEPHONE COMPANY.—Stockholders of the Cuyahoga Telephone Company met recently and ratified the plan for refinancing the company as proposed by the directors. The common stock of the company is to be reduced from $3,000,000 to $1,500,000 by reducing the par value of each share from $100 to $50. The company will issue $1,500,000 of 5 per cent. cumulative preferred (par value $50), which will be sold to present stockholders at $35. The money derived will be used for cancelling the debt of the company and for making needed improvements. The report of the president was very gratifying. February, 1903, the company showed a deficit of $29,685, and the expenses were 51.06 of the earnings. At present the company is earning a surplus, and the operating expenses are now 46.07 per cent of the gross. The company will soon close a contract for a large switchboard of the latest design.

CLEVELAND AND SHARON BONDS.—The Cleveland and Sharon Traction Company has filed with the County Recorder a mortgage for $2,000,000 5 per cent. gold bonds payable in twenty-five years, in favor of the Eastern Trust Company of New York City. The company is incorporated to construct a standard gauge electric railway from Middlefield, Ohio, to Sharon, Pa., also an extension from the main line at Kinsman, Ohio, to Meadville, Pa. The main line will connect with the Cleveland and Eastern Company at Middlefield, Ohio.

CENTRAL UNION TELEPHONE COMPANY.—The earnings for three years ended December 31, 1902, compare as follows:

	1902.	1901.	1900.
Gross	$3,003,717	$2,584,789	$2,309,471
Expenses and taxes	2,341,989	1,973,501	1,674,395
Net	$661,728	$611,288	$635,076
Interest on bonds	481,383	386,762	317,567
Surplus	$180,345	$224,526	$317,509

SEATTLE ELECTRIC REPORT.—The Seattle Electric Company reports as follows for the year ended March 31, 1903:

Gross	$1,944,863
Expenses	1,385,863
Net	$559,000
Charges	271,207
Surplus	$287,793

AMERICAN TELEPHONE AND TELEGRAPH.—It is stated that the directors of the American Telephone and Telegraph Company are considering the advisability of issuing $20,000,000 additional capital stock, which will be offered to stockholders at the ratio of one new share for every five now held, the proceeds of the issue to be used for improvements and to extend the company's lines in the west. There is a possibility that the date of the issue will be postponed until the money market becomes more propitious.

WELLMAN-SEAVER-MORGAN.—Plans for a consolidation of two of the largest engineering firms in the steel and iron business have been completed, with the result that the Wellman-Seaver-Morgan Engineering Company, of Cleveland, and the Webster, Camp & Lane Company have been merged into a corporation, with a capital

stock of $3,000,000. In addition, there is a mortgage executed to the extent of $800,000.

PUBLIC SERVICE CORPORATION.—The proposed lease of the Essex and Hudson County Gas Company for 999 years to the Public Service Corporation, the new $25,000,000 company which has taken over the traction companies of Essex, Hudson, Passaic and Bergen counties, New Jersey, is being opposed by minority stockholders. Influential interests in the big corporation say that a large majority of the stock will be voted in favor of the plan.

BOSTON EDISON INCREASE.—The stockholders of the Edison Electric Illuminating Company of Boston have voted to increase the capitalization of the company from $8,635,500 to $9,499,100 by issuing 8,636 new shares of stock, offered to stockholders of record June 2 at $200 a share, in accordance with the permission of the gas commissioners, at the rate of one new share for every ten shares now held.

DIVIDEND.—The Union Traction Company of Philadelphia have declared a second semi-annual dividend of 1½ per cent. The terms of the lease by which the Rapid Transit Company absorbed Union Traction last July were that for the first two years a dividend of 3 per cent. was guaranteed, the next two 4 per cent, the next two 5 per cent., and 6 per cent thereafter for the remainder of the 999 years.

POWER FOR GREENWICH, CONN.—The Glenville Power and Water Company has been organized at Greenwich, Conn., with $10,000,000 capital for the purpose of supplying water and electric power to Greenwich, Conn.; Rye, Harrison and Mamaroneck, N. Y.

Commercial Intelligence.

THE WEEK IN TRADE.—Wholesale trade is in a waiting attitude on crop, labor and price developments. According to reports received from all quarters, there is a favorable crop outlook, although the conditions are extremely varied, heavy rains being reported in some sections and droughts in others. The labor situation is still unsettled, close on to 100,000 men being idle in and near New York, as a result of the practical suspension of work in the building and allied trades. Building trades in other cities are hampered by labor troubles, notably at Chicago, Philadelphia and Kansas City. The iron situation has been partially cleared up by the buying of 85,000 tons of pig iron by the United States Steel Corporation at a price 50c. to 75c. below nominal quotations. A sale of 10,000 tons for June delivery has brought a higher price. Structural material is in good demand, notwithstanding labor troubles. Old iron and steel have been reduced in price. The outlook as to the country's export trade, according to *Bradstreet's,* is by no means depressing. Exports of manufactured goods for the month of April were only twice exceeded in the country's history. The copper market was extremely dull, but there were no changes in the "official" price. The prices quoted by producers are still 14¾ to 15c. for Lake and electrolytic, and 14½ to 14¾c. for casting stock. The business failures for the week ending May 28, as reported by *Bradstreet's,* numbered 181 against 155 the week previous, and 163 the corresponding week last year.

AUCKLAND, N. Z., LIGHTING PROJECTS.—The Australasian electrical engineering and contracting firm of Noyes Brothers, which concern represents the Westinghouse, Brill, Niles-Bement-Pond and other American manufacturing interests in the Antipodes, has submitted two plans to the municipal authorities of Auckland for the electric lighting of that New Zealand city. Two alternatives are suggested—the carrying out of the scheme by the city council on its own account or the granting of concessions to a private company to supply light and power. Mr. Goodman, who looks after the Noyes interests in New Zealand, suggests that the arc system should be employed in the main thoroughfares, while the narrow streets could be lighted with incandescent lamps. Altogether, 189 arc lamps of 1,000 candle-power would be required. The mains would be carried underground in the principal streets of the city, and the overheard system would be employed in the outlying portions. The area lighted would approximate eighteen miles of streets by arc lamps and thirty-six miles by incandescent lights. For generating purposes, steam is recommended. The cost of the foregoing system is estimated at $370,000. These estimates refer to the city proper. If all the suburbs embraced in the larger Auckland scheme were included, the number of arc lamps would be increased by seventy-three, and the number of incandescent lights by 3,475. A plant capable of meeting the larger demand would involve an estimated expenditure of $650,000. The British Electric Traction and Power Company, of London, which owns the Auckland traction system—built by J. G. White & Co.—have also offered to supply the needs of Auckland in the matter of light. It is suggested that they are able to do so more economically than any other supplier because their present capacity—1,000 horsepower—could be doubled without doubling the expense.

EXPORTATION OF MANUFACTURES in April was larger than in any preceding month in the history of our export trade, excepting the months of March and May, 1900. The total value of manufactures exported in April, 1903, was, in round terms, forty million dollars, against twenty-six millions in April, 1898; twenty-one millions in April, 1896; sixteen millions in April, 1895, and fourteen millions in April, 1893. Thus, comparing April, 1903, with April, 1893, the total is nearly three times as great. On only two occasions in the entire history of our export trade have the exports of manufactures during a single month reached as high a figure as that of April, 1903. The two months which show a larger total than April of this year are March and May, 1900. In March, 1900, the total exports of manufactures were $44,767,139; in May, 1900, $40,460,367; while in April of this year the total was $39,846,569. An examination of the details of the exports of these two months, which exceeded April of this year shows that the higher figures of these two months are due almost exclusively to the fact that iron and steel exports on those occasions were much larger than at present. The total value of iron and steel exported in March, 1900, was $11,858,387, and in May of that year, $12,026,681; while in April of the present year the total exports of iron and steel was $8,929,233. The total exports of manufactures in the ten months ending with April, 1903, are five million dollars in excess of the total for the corresponding ten months of last year, and practically the same as the total for the corresponding period of 1901, making it probable that the total exports of manufactures in the fiscal year which will close with June, will about equal those of any fiscal year, except 1900.

FISCHER 'BUS IN ENGLAND.—A Fischer combination electric and gasoline omnibus, built in Hoboken, N. J., for use in London, England, has arrived in that city, where it is attracting much attention. It is the first of a number of similar vehicles to be at once put into active service, the route being from the Angel, Islington, to Walham Green. The 'bus has a capacity of thirty passengers, having seats on the top which are reached by a stairway from the platform at the back. The engine and dynamo are in front, with the driver's seat above. The average speed is twelve miles an hour. The wheels have solid rubber tires. The gasoline motor is of the vertical four-cylinder pattern, and develops about sixteen horse power at 475 revolutions. The dynamo is coupled direct and has an output of nine kilowatts. The rear wheels are driven by separate motors suspended in front of the back axle. The battery consists of forty-eight chloride cells placed beneath the seats in the body. They have a capacity of 125 ampere hours at a three-hour rate of discharge. The electrical connections permit of the vehicle being run without the engine, and of the engine being started from the cells. Besides the ordinary electric brakes there are band brakes on each of the armature shafts of the motors and spoon brakes on the tires of the rear wheels.

IMPORTATIONS OF MANUFACTURERS' MATERIALS into the United States in the fiscal year which ends with June will be by far the largest in the history of our importations, and will amount to nearly or quite $500,000,000. Manufacturers' materials will form about 48 per cent. of the imports of the fiscal year. The ten months' figures of the Treasury Bureau of Statistics, just completed, show that manufacturers' materials formed 47½ per cent. of the imports for the ten months, and 49.77 per cent., or practically one-half of these of the latest available month, April; while in March they formed 49.06 per cent. Beyond doubt, the total importation of manufacturers' materials in the fiscal year 1903 will by far exceed that of any preceding year. The fiscal year 1902 was the banner one prior to the current year, its total being 415 million dollars; while the highest figure ever reached prior to 1902 was in 1900, when the total was 380 millions. The share which manufacturers' materials form of the total, as already indicated, will be about 48 per cent. of the total imports of the present fiscal year. In 1900 it was, in round terms, 46 per cent; in 1890, 34 per cent; in 1880, 37 per cent.; in 1870, 28 per cent., and in 1860, 25 per cent.

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, announces the purchase, on June 1, of the Carpenter Enclosed Resistance Company, of New York City. The manufacturing plant of the latter company will continue in operation here in the East, forming the nucleus around which the Cutler-Hammer Manufacturing Company is planning to build a much larger and thoroughly equipped plant for the manufacture of the well-known "C. & H." and "Carpenter" electric controlling devices. The Cutler-Hammer Manufacturing Company is very fortunate in being able to secure the services of Mr. Chas. E. Carpenter, who has been so long and favorably known in this particular line, and who at once enters its organization. Friends of both concerns are much pleased by the arrangement, and the Cutler-Hammer Company again demonstrates its progressive tendencies by thus increasing its facilities for catering to the growing demands of its clientele.

NEWARK WESTINGHOUSE PLANT.—The large increase in sales of integrating wattmeters and other electrical recording instruments by the Westinghouse Electric and Manufacturing Company has made necessary an extensive addition to the Newark works of this company. Appreciating the economic features and value of concentration, the meter branch of the electrical manufacturing business is here given that special attention requisite for the securing of perfection. The extension now being made will practically double the size and productive powers of this factory. The company manufactures its own meter tools, jewels and special appliances. While the mechanical features mark the perfection of their kind, equal attention has been given to the question of the comfort and convenience of the 3,000 employees. In plan, construction, and product this plant is a worthy member of the extensive Westinghouse family of industries.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, LIMITED, outbidding German and Austrian manufacturers, has won another large municipal contract in England, the competition among manufacturers having been unusually keen and speculation rife as to the successful tenders. The London County Council, however, at a recent meeting, closed a contract with the British Westinghouse Company, amounting to about $590,000, and calling for 200 tramcars, which are to be used on its lines south of the Thames. This is the largest order ever given for electric cars in England. One-half of the cars are to be of the single-track type, thirty-two tenders having been received for these. The remaining one hundred, for which twenty-six tenders were received, will be double-deck, bogie-truck tramcars, which are to be delivered in twenty-eight weeks.

GENERAL SUPPLIES FOR JAPAN.—Francis A. Amdill, 96 Wall Street, New York, who represents the electrical engineering and contracting firm of L. J. Healing and Company, Yokohama, is now purchasing various supplies, etc., in this market for shipment to the far East. The Holtzer-Cabot Company, of Brookline, Mass., has received an order from Mr. Amdill for its specialties. The Hazard Manufacturing Company, 50 Dey Street, New York, will supply some telephone wire for the Japanese government system. Baker & Company, of Newark, N. J., will ship some platinum wire. The Diamond State Fibre Company, of Elsmere, Del., has secured an order for insulating fibre, and the Mica Insulator Company, of 218 Wall Street, New York, has obtained a fair-sized order for its specialties.

IDEAL ELECTRIC AND MANUFACTURING COMPANY is the name of a new concern just started at Mansfield, Ohio, by Messrs. S. Glen Vinson, who is its secretary and treasurer, and Mr. S. E. Huenerfauth as superintendent. The other officer is Mr. C. H. Voegele, president. The company is duly chartered under the laws of Ohio, and is erecting a modern fireproof building, which it will equip with the latest tools and appliances for the manufacture of a complete line of electrical machinery and appurtenances. The concern, which has offices for the present at Room 5, Blecker Block, Mansfield, would like to receive catalogues of machine tools, cranes, power equipment, etc., as well as of materials used in the production of electrical machinery.

THE CALEDONIAN RAILWAY.—Considerable interest has been shown by the railway officials in Scotland on two recent occasions when the powerful express locomotive built for the Caledonian Railway appeared at one of the Company's stations on trial runs. Though the engine is not yet finished and was unpainted, the massive proportions and liberal dimensions of the mechanical details were such as to attract the attention of even the general public. The engine is fitted with Westinghouse air brakes, and when completed, will weigh about 74 tons; while with the tender, six tons of coal and 5,000 gallons of water, the total weight will be about twenty tons more than that of any other locomotive in the British Isles.

BALL ENGINE ORDERS.—The Pennsylvania Railroad Company has purchased from the Ball Engine Company, Erie, Pa., for its Altoona shops, a 450-hp, tandem, compound engine, direct-connected to General Electric alternator. This engine is the fifth of this size purchased within two years from the Ball Engine Company. The Menominee Sugar Company, Menominee, Mich., will have an electric plant, consisting of two engines of 150-hp direct-connected to Crocker-Wheeler generators. The Ball Engine Company furnishes the engines, which are of the self-oiling type.

EQUIPMENT FOR CANADIAN COPPER PLANT.—The Canadian Copper Company, controlled by the International Nickel Company, 74 Broadway, New York, is now letting contracts in this market for considerable equipment for its new plant at Copper Cliff, Ont., which will eventually be operated by electricity. Thayer & Company, incorporated, have taken the boiler contract, which calls for four Cahall units of 400-hp capacity each. The engine will be of Corliss type, the Nordberg Manufacturing Company, of Milwaukee, having taken the contract.

HEATING AT RED OAK: A CORRECTION.—In the article on "Development of Light and Power Business at Red Oak, Iowa," in the issue of this paper for May 23, 1902, a statement was made that the Yaryan hot-water heating system was used there, which was an unaccountable error, for which the writer of the article wishes to humbly apologize, inasmuch as the Red Oak hot-water heating system is, as is well known to many readers of this paper, one of the oldest and most notable central station hot-water plants of the Evans-Almirall Company.

CONTRACTS FOR JAPANESE LIGHTING PLANT.—The Kobe Electric Light Company, Japan, is to double the capacity of its plant. American equipment will be installed. The machinery now called for will have a capacity of about 500 hp. The General Electric Company will supply the generator. The engine—a horizontal tandem one—will be built by McIntosh & Seymour. The Blake end of the International Steam Pump Company will ship the condensing equipment. The boilers will be Babcock & Wilcox.

BISHOP AND BABCOCK PLANT.—In addition to the equipment previously purchased from the Westinghouse Electric and Manufacturing Company, the Bishop and Babcock Company, of Cleveland, Ohio, has recently installed a 175-kw, two-phase, engine-type generator, direct-connected to a Ball engine, together with an exciter and four 40-hp and one 20-hp type induction motors. Geo. S. Rider & Company, of Cleveland, were the consulting engineers.

LIGHTING A CIRCUS.—Note was made recently in these columns of lighting Ringling Brothers' circus with Nernst lamps. We may add that the Marinette Iron Works, of Marinette, Wis., furnished for this installation two 30-hp, three-cylinder, Walrath gasoline engines, mounted on steel trucks. This makes a very neat outfit with the dynamo, and Ringlings already had two complete outfits of this size giving excellent results.

EQUIPMENT FOR TRANS-CASPIAN RAILROAD.—Several very large contracts are expected very shortly for American electrical equipment, machine tools, etc., for the Trans-Caspian railroad now under construction by the Russian government. The Russian Ministry of Ways and Communications is engaged in drawing up the specifications, which it is reported will call for an expenditure exceeding $5,000,000.

JAPANESE CONTRACT PENDING.—The Sanyo Railway Company, South Japan, is about to let contracts for an extension to its plant. The equipment will be of American manufacture. The specifications call for a 250-kw generator, 550 volts, 60-cycle, for direct connection to a vertical compound engine of 350-hp capacity. Exciters will also be ordered.

MACHINE TOOLS FOR THE PHILIPPINES, ETC.—The Dreses Machine Tool Company, of Cincinnati, Ohio, has been awarded a large contract for machine tools to be installed in the United States coaling station at Cavite, Philippine Islands. Orders have also been received recently for various tools to be shipped to Sweden, Denmark and Italy.

WESTINGHOUSE TRACTION BRAKES.—The Westinghouse Traction Brake Company has received an order from the St. Louis Rapid Transit Company to put brakes on 2,000 cars for use during the rush season, attendant upon the exposition. The order also includes the installation of forty compressor plants throughout St. Louis.

PIPE, ETC., FOR SOUTH AFRICA.—The Crane Company, of Chicago—New York offices, 490-502 Cherry Street—have secured a large South Africa contract for pipe, etc.

MILLING MACHINES FOR FRANCE.—The Cincinnati, Ohio, Milling Machine Company has been allotted a substantial French order for its specialties.

PELTON CONTRACT FOR THE ARGENTINE. The Pelton Water Wheel Company, 143 Liberty Street, has been awarded a large Argentine Republic contract.

ELECTRICALLY-DRIVEN TOOLS FOR AUSTRALIA.—The J. A. Fay and Egan Company, of Cincinnati, have taken a large contract for wood-working machinery to be shipped for installation in Australian railroad shops, and operated by electricity.

TOOLS FOR JAPANESE ARSENAL.—The American Tool Works, of Cincinnati, Ohio, will build several machine tools for shipment to the Japanese government arsenal at Kobe, where they will be electrically driven.

BARNES MACHINE TOOL FOREIGN CONTRACTS.—The W. F. and John Barnes Company, of Rockport, Ill., has lately secured good orders for its various specialties for shipment to Mexico, France, Belgium, Holland, Germany, Italy and Australia.

General News.

THE TELEPHONE.

POMONA, CAL.—The Pomona Valley Telephone Union has been organized and is at work installing an extensive system.

SAN PEDRO, CAL.—The Town Trustees have sold to J. C. Brainard a 35-year telephone and telegraph franchise for $100.

WHITTIER, CAL.—E. W. Bacon, representing the Home Telephone Company, has purchased a telephone franchise from the town of Whittier for $100.

LOS ANGELES, CAL.—The Pasadena Home Telephone & Telegraph Company has incorporated with a capital stock of $500,000, of which amount $10,000 has been subscribed. The directors for the first year are John Van Liew, F. W. Wachter, D. F. Boyce, Arthur Wright and F. F. Graves.

DENVER, COL.—The Rocky Mountain Telegraph & Telephone Company has commenced an action in the district court to have the transfer of franchise and license made by S. W. Jacobs to the Denver Telephone Company declared null and void. It is contended by the plaintiff that the transfer was made by fraud and that the Denver Company has no right to operate under the franchise.

SAVANNAH, GA.—The underground system of the Southern Bell Telephone Company in Savannah will be considerably extended if the necessary permission can be secured from the city.

ATLANTA, GA.—A charter has been granted to the American Telephone & Telegraph Company, of Atlanta, with a capital stock of $25,000. E. J. Hall, of Morristown, N. J., W. E. Holcomb, of New York, A. Ward Cobb, of Atlanta, and others are interested. Work will begin at once constructing lines through the state.

COSAM, ILL.—The Cosam Camp Ground & Mt. Vernon Telephone Company has been incorporated with a capital of $2,500. The incorporators are James G. Williams, G. W. Clark and W. W. Duncan.

CARLINVILLE, ILL.—W. Roy McCann, of St. Louis, assistant secretary of the Kinloch Telephone Company, has closed a contract with the Macoupin Telephone Company, of Macoupin County, whereby they are to build jointly two metallic circuit lines from Alton to Springfield through this city, giving the Macoupin Company connection with St. Louis and the rest of the country and the Kinloch Company connections with Macoupin County and other cities having the independent system throughout this section. The contract calls for the new lines from St. Louis to Springfield within a year, but Mr. McCann says they hope to have the same completed by September.

MT. VERNON, IND.—The Posey County Telephone Company has filed articles of incorporation. The capital stock is $50,000. Allen Gray, Wm. M. Tow and others are the incorporators.

SALEM, IND.—The Hoosier Telephone Company will install a new exchange and offices here. The company's system covers Washington and adjoining counties. A number of improvements will be added.

GREENFIELD, IND.—The Ward Telephone Company of Hancock County, has incorporated with a capital stock of $1,400. A neighborhood farmers' system will be put in operation. J. M. Newhouse is president.

RICHMOND, IND.—The Home Telephone Company of this city has a hundred applicants waiting for service which cannot be had at present for lack of sufficient cables to carry the wires. The company will expend $10,000 in new cables and needed extensions.

MADISON, IND.—The Jefferson Telephone Company has incorporated with a capital stock of $10,000. The company will build lines and exchanges in Jefferson, Clark, Scott, Jennings, Ripley and Switzerland counties. Wm. A. Kirk, J. M. Benson and John McGregor are the incorporators.

GREENFIELD, IND.—The Sugar Creek Farmer's Telephone Company changed its name to New Palestine Telephone Company of Hancock County and the capital stock was increased to $15,000. The company will make extensive improvements. Henry N. Myers is president and Gas. Shramm, secretary

ALEXANDRIA, IND.—Farmers east of this city have organized a country telephone exchange which will cover a large part of Monroe township and connect with the Alexandria exchange. Marshall Walker, a former county commissioner, is at the head of the company which is backed by ample capital.

CRAWFORDSVILLE, IND.—The city council has granted the Crawfordsville Co-operative Telephone Company a franchise to run two lines of poles and wires in this city. The franchise contains some rigid provisions favorable to the city. The charges for residence telephones shall not be more than $6 and for business not more than $13 per year.

LOGANSPORT, IND.—The Northern Indiana Telephone Company has incorporated with a capital stock of $10,000. The organization is, in a sense, a merger of twenty-five companies operating in northern Indiana. The object is to pool the long-distance business of the various companies. The territory covered by the company will be from Lafayette in the south to South Bend on the north and from Chicago on the west to Winchester on the east, including forty-seven counties. The first move of the new company will be to build a number of toll cables out of Logansport where the company will maintain headquarters. These improvements the company considers will place the independent companies on a par with the Bell Company.

EVANSVILLE, IND.—The ordinance granting a franchise to the Evansville Municipal Telephone Company provides that at any time after the preferred stock has been redeemed the city may, at its option, purchase all property rights, contracts, franchises and all other assets of the company at a price equal to the par value of the outstanding common stock, and that itthereupon shall distribute the money paid for the same to each of the shareholders of such common stock *pro rata*. The city is the holder of 7,900 shares of the common stock, that being a large majority. The franchise is for a term of twenty-five years. The following charges have been decided on. Full metallic long-distance instruments for business houses not less than $3 nor more than $4 per month. Residences metallic long-distance $2. Party lines, selective signal, two on a line, $1.50. Four on a line $1. Mayor Covert says work will begin in ten days on the municipal plant.

LANSING, MICH.—The Benzie County Telephone Company has increased its capital stock to $50,000 and will make extensions. W. A. Young is president and H. B. Woodward, general manager of the company.

PINE RIVER, MICH.—The Pine River Telephone Association has been organized by local farmers and a number of farmers' lines will be installed. Connection will be made with the lines of the Union Telephone Company.

ELLENBORO, N. C.—The Ellenboro Telephone Company has been chartered by the secretary of state.

NEWARK, N. J.—The Northeastern Telephone and Telegraph Company, Newark, has been incorporated, capital $100,000. Incorporators: Union N. Bethell, William T. Bouchelle, Walter Brown, John H. Cahill and Howard Thurber.

XENIA, OHIO.—The Citizens Telephone Company is building new lines to Yellow Springs and Clifton.

ATHENS, OHIO.—The Athens Telephone Company is building a line to Uniontown and will connect up a large number of farmers.

WAPAKONETA, OHIO.—The Auglaize Telephone Company is building a line to St. Johns and will connect with the farmers in that district.

WARREN, OHIO.—The Phalanx & Leavittsburg Telephone Company has completed a line to Leavittsburg, giving it connection with all the lines of the Warren & Niles Telephone Company.

CONTINENTAL, OHIO.—The Putnam Telephone Company has 125 subscribers as compared with 79 a year ago. About fifty people are on the waiting list and the system will have to be enlarged to take care of them.

CANTON, OHIO.—The Stark County Telephone Company will spend $80,000 in immediate improvements. The company has nearly 500 names on the waiting list and will install a new switchboard to bring the capacity up to 3,500. A large amount of new cable will be erected in the city and new toll lines will be built to Middlebranch, Congress Lake, Hartville, New Baltimore, Uniontown, Greentown, Waynesburg, Magnolia and other towns.

OTTAWA, ONT.—A powerful rival to the Bell Telephone Company in Canada is now in process of formation. An application is before the Canadian parliament, on behalf of a number of American capitalists, principally residents of Philadelphia, for a charter for a telephone company with rights throughout the Dominion of Canada. The capital of this company is to be $30,000,000. The capitalists interested are also negotiating to purchase, or have already bought out the Merchants' Telephone Company, of Montreal, which company is only authorized to operate in the province of Quebec and most of the capital stock of which is now controlled by American capitalists. As soon as the Dominion government grants the charter to the company first referred to, it is understood that it will absorb the Merchants Company.

ST. GEORGES, S. C.—The St. Georges Telephone Company, M. S. Cannon, president, has been chartered with a capital of $5,000.

WILMINGTON, S. C.—The Southern Bell Telephone Company has just moved into its new exchange here. The wires in the business section have recently been placed underground.

CLARKSVILLE, TENN.—The Home Telephone Company, of Clarksville, is building a number of out-of-town connections to Guthrie and other points.

CHATTANOOGA, TENN.—The Hamilton Telephone and Power Company has applied for a charter in Chattanooga. It will probably establish an electric light plant. The company has strong financial backing.

PROVO, UTAH.—The Rocky Mountain Bell Telephone Company announces that its system will be extended in the near future to the small towns surrounding this city.

ELECTRIC LIGHT AND POWER.

SKAGWAY, ALASKA.—The Northwest Light & Power Company has the alternating-current system of the Stanley Electric & Manufacturing Company. The one dynamo is of 100-kw capacity. The company supplies 1,000 incandescent lamps of 16 and 32 candle power. Besides the steam plant, there is a water power developed by a Tuthill wheel of 175 horse power. Mr. Chas. D. Shepard, of Seattle, Wash., is president of the company, and Chas. H. Kiehl, of Seattle, is secretary and treasurer.

SANTA MARIA, CAL.—The Board of Supervisors has granted to Reuben Hart a 50-year franchise for an electric light and power system in the town of Santa Maria.

LOS ANGELES, CAL.—One of H. E. Huntington's large brickyards near Los Angeles is to be equipped for brick-making by electric power with a capacity of 40,000 brick per day.

FORT COLLINS, COL.—The Lonmer Light & Power Company has a capital of $50,000. It operates an alternating system, its lighting system consisting of 42 direct-current and 20 enclosed-arc lamps and 5,825 incandescents. It charges 10 cents per kw-hour for motor power.

GRIFFIN, GA.—Capt. Saton Grantland is interested in developing a large water power near here. The cost is estimated at about $200,000. Four thousand horse power is available.

SOUTH WHITLEY, IND.—The South Whitley Electric Light Company has increased its capital stock $12,000 and will make extensive improvements and install some new machinery.

RUSHVILLE, IND.—The report of the municipal electric light plant for the year ending May 1, shows an excess of receipts over expenditures of $842.10.

The plant has been self-sustaining for four and a half years and has given the people good service at low cost.

INDIANAPOLIS, IND.—The Board of Public Works has completed the specifications for the electric lighting contract for ten years, beginning January 1, 1905. The purpose of postponing until that date being that a successful bidder without a plant would have time to construct one. As a consideration the city offers to award a franchise for private lighting for a period of twenty-five years to the successful bidder for public lighting, the charge for private use not to be over 10 cents per kw-hour and the city to receive 5 per cent, of the gross receipts. The city reserves the right to buy the plant. Specifications and provisions of the contract are now ready to be sent out. Address Fred Joss, City Attorney.

STUART, IA.—The municipal plant furnishes twenty-nine 1,200-cp. arc and 100 incandescent lights.

FORT MADISON, IA.—The electric light plant of S. & J. C. Atlee has 87 arc lights and 4,000 incandescents.

NORTHWOOD, IA.—Mr. L. F. Madson is owner and manager of the Northwood Lighting Company, which has a capital stock of $10,000. He informs us that there is a good opening for an electric railway of about 18 miles, through a good country and two towns. The people want it and need it.

MASON CITY, IA.—The Brice Gas & Electric Company has a capital stock of $150,000, and operates both alternating and direct-current systems. It has 150 arc lights and 7 miles of circuit. It has a motor service including about 50 machines, the prices for such service being 10 and 5 cents per kw-hour.

FAIRFIELD, IA.—The city owns the electric light plant, which is a very old one, and the question of replacing it with up-to-date machinery is to come up. At present there are twenty 2,000-cp arc lamps. There is an independent company here with a 15-year franchise to furnish incandescent lights.

ATCHISON, KAN.—The Atchison Railway, Light & Power Company has increased its lighting to 200 arcs and 12,000 incandescent lights. It furnishes 500-hp motor power at rates from 5 cents to 10 cents per kw-hour, and has ten miles of car track, nine motor cars and ten trailers.

HENDERSON, KY.—This place has a municipal plant which operates 225 2,000-cp arc lights and 2,500 1*-cp incandescents. Twelve motors are furnished power at five cents per kw-hour, 5 to 20 per cent. discount.

CROWLEY, LA.—The Crowley Water Works & Electric Light plant has 23 arc lamps and 1,000 incandescents. The system is to be extended and a new plant of 10,000 light capacity put in. All machinery is required.

HOULTON, ME.—The electric light plant is the property of E. Merritt & Sons. It operates 15 arcs and 3,000 incandescent lights.

ROCKPORT, ME.—Seven thousand dollars in bonds have just been voted for the electric light plant, which is increasing its capacity. It now has 490 domestic and 180 street incandescent lights.

LAWSON, MD.—The electric light system is to be changed in the near future and a generator and storage battery will be required.

SALISBURY, MD.—The Salisbury Gas & Electric Light Company, E. G. Frost, manager, has $50,000 stock and $50,000 bonds. It furnishes seventy-seven 1,200-cp arc lamps and 1,600 16-cp incandescents.

HAZELHURST, MASS., established a municipal plant in 1902, with $45,000 bonds. It operates seven miles of wire, 35 arc lights and 1,800 incandescents.

STOUGHTON, MASS.—The Stoughton Gas & Electric Company, C. H. Swan, manager, has 37 miles of circuit, 73 arc lights, 2,800 incandescents and nine motors.

GARDNER, MASS.—The Gardner Electric Light Company has $65,000 capital stock, and operates 120 1,200-cp. arc and 6,000 16-cp incandescent lights. Motors are run on a sliding scale basis.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has $90,000 capital stock and furnishes 30 arcs and 6,000 incandescents; also motors of 300-hp at ten cents to three cents per kw-hour.

BELLERICA, MASS.—The Lowell Street Railway Company has absorbed the Bellerica Electric Company, but a sub-office is maintained here. The town is lighted by 100 25-cp series incandescents and some 2,500 16-cp are in private use.

CLINTON, MICH.—The municipal electric light plant furnishes thirty-five 1,200-cp arc lamps and 1,200 incandescents.

MT. CLEMENS, MICH.—The Mt. Clemens Electric Company operates 150 1,200-cp arc lights and 7,500 16-cp incandescents.

HOLLY, MICH.—The Holly Electric Light & Power Company operates thirty-four 2,000-cp street arcs and 1,400 incandescents.

OTSEGO, MICH.—The electric light plant furnishes the village with 34 arc lamps. It gets current from the Kalamazoo Valley Electric Company.

PLAINWELL, MICH.—Messrs. Arnold & Brownell, owners of the electric light plant want 20 meters; 220 volts and 5 to 25 amperes, direct-current 2-wire.

FREMONT, MICH.—The Fremont Electric Light & Water Works, a municipal plant, has recently placed its service on a meter basis. There are twenty 2,000-cp arcs and 1,600 16-cp incandescents.

ISHPEMING, MICH.—The Negaunee & Ishpeming Street Railway & Electric Light Company operates 80 arc lights, forty 2,000-cp, forty 1,200-cp. It runs 15 motors at ten cent rates and several electric cars.

MILFORD, MICH.—Mr. F. S. Hubbell is the owner of the electric light works which operates 23 arc lights and 2,000 incandescents. Mr. Hubbell has plenty of power to spare by day, and would like to engage in some electrical manufacture.

THREE RIVERS, MICH.—The Three Rivers Light & Power Company furnishes 85 2,000-cp arcs and 3,000 16-cp incandescent lights and charges eight cents per kw-hour for motor power. There is splendid water power and a good route for an electric railway.

NEW RICHLAND, MINN.—The electric light plant, owned by Lea & Borge, furnishes five 2,000-cp arcs and 600 incandescent lights.

RED WING, MINN.—The Red Wing Gas & Electric Company, J. C. Pierce, president, has 45 street arcs and 92 incandescent lights.

OLIVIA, MINN.—It is the intention to install a larger dynamo engine and boiler in the municipal plant during the present season. The plant is under the control of the village council.

CHATFIELD, MINN.—The Chatfield Electric Light & Power Company has $50,000 capital stock, of which $22,000 is paid up. Jos. Underleak is president. It has about twelve miles of wire, twelve 1,200-cp arc lamps and 1,788 incandescents, mostly 32-cp.

RED LAKE FALLS, MINN.—The Red Lake Falls Electric Light Company, which was formed in 1898, has $8,000 capital stock. M. Johnson is president and S. M. Sivertson, secretary and treasurer. It has in operation twenty-four 2,000-cp arc lights and 1,600 16-cp incandescents.

ST. CLOUD, MINN.—The Light, Heat, Transit & Public Service Company, E. E. Clark, manager, operates a General Electric system, having 80 miles of circuit, 180 arc lights and 8,000 incandescents. It runs 11 cars on a charge of three cents per kw-hour; its motor rates being five cents to six cents per kw-hour.

KOSCIUSKO, MISS.—The Kosciusko Oil Mill & Fertilizer Company operates a General Electric plant of thirty-five 2,000-cp arcs and 1,500 16-cp incandescent lights.

GRENADA, MISS. owns a municipal plant of 30 arc and 1,500 incandescent lights. C. B. Bolton is superintendent. The Ayer Loyd Tie Company wants a complete installation of electrical equipment.

BATESVILLE, MISS.—The Panola Electric Light & Power Company was organized in April, 1903, with $12,000 capital. D. L. Rush and Roy Bell are partners. It has 15 miles of circuit and 1,000 16-cp incandescent lights.

MERIDIAN, MISS.—The Meridian Light & Railway Company has $250,000 capital and 200,000 bonds, and operates 120 arc lights and 5,000 incandescent lights. It runs four cars over 5½ miles of track, and is about to extend its line.

YAZOO CITY, MISS.—The Yazoo Improvement Company has sold its plant to the municipality. The city has sold $175,000 of bonds to a Cleveland firm. It will make improvements and extensions to cost about $150,000 to the water, light and sewage systems.

SEDALIA, MO.—The Sedalia Electric Light & Power Company operates 100 arc and 1,500 incandescent lights.

ST. LOUIS, MO.—The following named gentlemen were elected officers of the West St. Louis Water & Light Company: Thos. W. Crouch, president; J. B. Quigley, first vice-president; John F. Lee, second vice-president; E. S. Lewis, secretary and treasurer; N. D. Thompson, assistant treasurer; B. V. Beckman, assistant secretary.

WAHOO, NEB.—S. H. Jones owns the lighting plant and operates five 1,200-cp arcs and 1,200 16-cp incandescents.

TONOPAH, NEV.—The Tonopah Light & Power Company was organized in 1902 with $50,000 capital; W. C. Watson is president. The system is General Electric, there being 2½ miles of circuit, three arcs of 2,000-cp and 1,200 16-cp incandescent lights.

PLYMOUTH, N. H.—The Plymouth Electric Company has a capital stock of $10,000, the officers being J. N. McCoy, president, and F. C. Calery, treasurer and manager. The company's system is the Edison direct-current, there being two dynamos of 25-kw capacity each. The lighting consists of 7 arc lamps and 1,600 incandescents.

HICKORY, N. C.—The Thornton Light & Power Company is installing a $27,000 lighting plant in Hickory. M. E. Thornton is president of the company.

ASHEVILLE, N. C.—The W. T. Weaver Power Company of Asheville has let the contract to C. R. Willis for a dam across the French Broad River, five miles from Asheville, where a large electric plant is being erected. It is expected that the plant will be completed by September 1. (See article elsewhere in this issue.)

MAUMEE, OHIO.—The Maumee Electric Company has a capital stock of $30,000, and bonds to the amount of $10,000. Mr. D. W. Tryon is president and A. C. Tryon secretary and treasurer. The company operates an alternating current system, using Bullock and Warren generators. The lighting system consists of 36 arc lamps and 2,000 incandescents. Besides the regular steam plant, th company has a Sampson water wheel. The company does a general supply business in addition to its electric lighting service.

OTTAWA, ONT.—A charter has been secured from the Canadian parliament for the Sault St. Louis Light & Power Company to develop power from the Lachine Rapids, and at Ile Heron, Ile au Diable, and adjacent islands in the St. Lawrence River. The charter also provides for authority to manufacture calcium carbide and to operate vessels. The capital of the new company is placed at $1,000,000, and its headquarters are to be in Montreal, Que.

SALEM, ORE.—The Salem Light, Power & Traction Company has entered into a twenty-year contract with the Union Light & Power Company, of Portland, for the supply by the latter of all the electrical energy repuired during that period, which will be transmitted a distance of 17 miles to Salem.

SILVERTOWN, ORE.—The Union Light & Power Company, of Portland, is supplying current from its new power plant on Silver Creek to Woodburn, Silvertown, Mt. Angel and the Benedictine priory and college at the latter place.

COATICOOK, QUE.—The entire plant of the Coaticook Electric Light & Power Company has been purchased by the town of Coaticook, Que., for $36,000, and the corporation will assume control October 1, next. This action has settled amicably and satisfactorily a long and bitter dispute.

BISHOPVILLE, S. C.—The Lee County Manufacturing Company of Bishopville, has been granted a franchise to light the town by electricity.

THE ELECTRIC RAILWAY.

LOS ANGELES, CAL.—The Los Angeles & Glendale Electric Railway Company has incorporated, capital stock $1,000,000. Directors: L. C. Brand, R. H. Howell, E. T. Stimson, W. H. Holliday, George F. Cope, all of Los Angeles.

BAKERSFIELD, CAL.—The Bakersfield & Ventura Railway Company has incorporated, capital stock $5,000,000. Incorporators: H. M. Russell, Eben Smith, J. W. Burson, Gervais Purcell, A. N. Sanford, J. W. Swanwick, all of Los Angeles.

HARTFORD, CONN.—The House has passed a resolution incorporating the Wallingford Tramway Company. The incorporators are Walter J. Leavenworth, Frank A. Wallace, George E. Dickerman, Charles B. Yale and Ralph T. Ives, of Wallingford.

WASHINGTON, D. C.—The Chesapeake Beach Railway Company has under consideration the subject of converting its line into an electric railway.

FREEPORT, ILL.—The City Council has passed an ordinance granting a railway and lighting franchise for twenty years to the Freeport Electric Company.

STERLING, ILL.—The contract for constructing the Sterling, Dixon & Eastern Electric Railway has been awarded to the Columbia Construction Company, of Milwaukee, Wis. About 17 miles of road are to be built.

MOLINE, ILL.—It has been decided to increase the capital stock of the Kewanee, Cambridge & Geneseo Railway, which has in contemplation the construction of an electric railway to connect Kewanee, Cambridge and Geneseo, from $100,000 to $850,000.

METROPOLIS, ILL.—Capitalists in Paducah, Ky., and Cairo, Ill., and in the intermediate country are taking steps to organize a company for the purpose of building an electric railway between Paducah and Cairo, through the Kentucky territory opposite here. The distance is about 25 miles.

BELLEVILLE, ILL.—The City Council has granted twenty-year franchises to the Belleville & Mascoutah Electric Railway and the Belleville & Freeburg Electric Railway, to operate on certain streets of the city. A franchise has also been granted the Interurban Electric Railway Company to operate here.

DECATUR, ILL.—The Decatur, Springfield and St. Louis Railway Company, with a nominal capital stock of $500,000, has been incorporated here. The company is financed by Montreal, Canada, and Boston, Mass., capitalists, and a Montreal insurance company, the syndicate which owns the street railway and lighting and power plants of about a dozen Illinois cities.

SHELBYVILLE, IND.—The Shelbyville Traction Company is reported to have perfected arrangements for extending its line from Shelbyville to Greensburg, a distance of 20 miles. It is understood that the company plans eventually to extend the road to Cincinnati, a distance of 64 miles.

LOGANSPORT, IND.—The Logansport, Hammond & Chicago Traction Company has been incorporated, with a capital stock of $1,000,000, as an extension of the Union Traction Company's system now being built from Indianapolis to Logansport, and when completed will connect Indianapolis with Chicago. The incorporators are George F. McCulloch, Horace C. Stilwell, A. L. Drum, Harry E. Guthrie and Arthur W. Beady.

MADISON, IND.—In about sixty days the Madison, Greensburg & Indianapolis Railway Company expects to be ready to let contracts for furnishing the equipment and constructing its proposed line. The plan is to build between Madison and Osgood first and eventually extend the road to Greensburg. Thirty miles of line are to be built. The officers of the company are Richard Johnson, president; M. D. Wilson, vice-president and general manager; Lincoln V. Cravens, secretary; N. Horuff, treasurer.

BURLINGTON, IA.—The Burlington & Keosauqua Railway & Power Company is projected to build an interurban electric railway to Keosauqua. It is said that surveys have been made.

AUGUSTA, MAINE.—The Lincoln County Street Railway has completed its organization, electing Luther Maddocks, president and general manager; Cyrus W. Davis, treasurer; H. M. Heath, clerk and general counsel. The proposed road will run from Wisassett to Boothbay Harbor, with a branch to Newcastle.

HAGERSTOWN, MD.—The Hagerstown Electric Railway Company proposes to extend its lines from Boonesboro, Washington County, across South Mountain to Myersville, Frederick County.

LAUREL, MD.—The Laurel Traction Company has been granted a franchise for the construction of a third-rail electric railway in Laurel. Chas. L. Fox, Maury S. Chism and Chas. J. Barth, of Philadelphia, are interested.

BOSTON, MASS.—The Boston Elevated Company has voted to lease from the Old Colony Street Railway Company the whole of the railway and property of that company located within the city of Boston.

MIDDLETON, MASS.—The Middleton & Danvers Street Railway Company has petitioned the Railroad Commissioners for authority to increase its capital stock $24,000 for the purpose of purchasing the Haverhill & Andover Street Railway, and the Lawrence & Reading Street Railway has petitioned for the authority to increase its stock $24,000 to purchase the Reading, Wakefield & Lynnfield Street Railway.

DETROIT, MICH.—The attempt of the Michigan Legislature to pass the Gruesel bill, which provides for municipal ownership of the street railways of Detroit, has been defeated, for the present, at least.

HAZLEHURST, MISS.—Plans are being discussed for building an electric railway from Hazlehurst Point to Gallatin. R. P. Willing, Jr., is interested.

NASHUA, N. H.—The Goff's Falls, Litchfield & Hudson Railway Company has perfected its organization and will proceed with the work of perfecting arrangements for building its proposed line. The officers are Isaac N. Carter, of Litchfield, president; Arthur S. Campbell, of Manchester, vice-president; John J. Baker, of Hudson, treasurer.

OWEGO, N. Y.—The Binghamton Railway Company has filed application for permission to extend the line from the present terminus at Vestal to Owego.

NEWBURGH, N. Y.—Fred T. Ley & Company, of Pittsfield, have been awarded the contract for extensions of the Orange County Traction Company's system in and about Newburgh.

ALBANY, N. Y.—The Nichols and Northern Pennsylvania Railroad Co., of Nichols, has been incorporated, capital $40,000. Directors: C. L. B. Tylee, T. M. Fonts and R. B. Randall, Newark.

LITTLE VALLEY, N. Y.—A certificate of incorporation has been filed for the Ellicottville, Mansfield & East Otto Railroad Company. The capital stock is $300,000. The Board of Directors for the first year is composed of John S. Rockwell, Philip A. Laing, Clarence W. Hammond, Buffalo; Chas. G. Locks, Randolph; William G. Laidlaw, Charles A. Cease and John G. McMahon, Ellicottville; Hudson Ansley and Edward Bolard, Salamanca; Albert T. Fancher and Adelbert E. Darrow, Little Valley, and Owen S. Laing, Floyd W. Holmes, J. DeMott Laing and Charles T. Mason, East Otto.

OKLAHOMA CITY, OKLA.—The Oklahoma Electric Company has been incorporated to build an electric railway to connect Oklahoma City, Norman, El Reno and Shawnee. The capital of the company is $1,000,000, and the incorporators are F. B. Ziegler, William Young, J. S. Alexander and others.

LAWTON, OKLA.—The Lawton Street Railway Company has just been incorporated. Besides operating street cars the company will furnish power for lighting and commercial purposes. The company is capitalized for $600,000, and among the incorporators are W. J. Pearson, of New York; S. O. Crutcher and W. E. Hudson.

KINGSTON, ONT.—The promoters of the Ontario Electric Railway are said to have decided upon developing power by damming the Trent River at Glen Miller, 7 miles from Trenton. An amendment will have to be secured to the act of incorporation.

LANCASTER, PA.—The Conestoga Traction Company has decided to survey for an extension of the New Holland branch to Terra Hill, a distance of almost five miles.

MOUNT PLEASANT, PA.—Surveys are completed for the new road of the Mount Pleasant, Unity & Baggaley Street Railway Company. This line will be 16 miles long.

CHAMBERSBURG, PA.—The Chambersburg & Gettysburg Electric Railway Company has given the contract for the overhead work on its line to I. J. Larch, of Reading. Two power houses will be erected, one at Fayette and one at Wolf Lake.

SHENANDOAH, PA.—The Shenandoah & Suburban Railway Company has been incorporated to build an electric railway from Shenandoah to Ringtown. The officers are Dr. J. M. Langdon, president; J. S. Hossnick, secretary; M. M. Mellett, treasurer.

EASTON, PA.—The Easton & Washington Traction Company has filed articles increasing the capital stock of the company from $100,000 to $1,250,000. This company contemplates building an electric railway from Easton to Hackettstown. The power house will be built at Washington.

WILKESBARRE, PA.—The Wilkesbarre & Wyoming Valley Traction Company has decided to spend $200,000 on betterments to its system during the coming year. A large storage battery is to be installed at Pittston and a new engine and generator will be placed in the South Wilkesbarre power house. The North Main Street line is to be rebuilt.

CONNELLSVILLE, PA.—The Pittsburg, McKeesport & Connellsville Electric Railway Company has filed a plan for the proposed extensions from Fairchance to the Pennsylvania-West Virginia State line, and from Fairchance to Smithfield and across George Township. The company is installing an electrical signal system along the Connellsville Division. If it proves a success it will be placed along the entire system.

HARRISBURG, PA. The shareholders of the Harrisburg Traction Company adopted the plan proposed by the directors for the formation of a new company with a capital of $2,100,000, to lease the present Harrisburg Traction Company at a guaranteed rental of six per cent. on its $2,100,000 stock, to which amount the existing stock will be increased by payment of a five per cent. stock dividend. The plans include a new power plant, new equipment, extension of lines in the city and to Dauphin, Linglestown, Hummelstown and possibly in other directions.

CHATTANOOGA, TENN.—Negotiations for the merging of the street railways of Chattanooga are said to have been practically concluded. The new company will be known as the Chattanooga Light & Power Company, chartered in New Jersey with $750,000 capital. Large sums of money will probably be expended in improvements.

LAREDO, TEX.—The Laredo Electric Light & Street Railway Company is planning to make a number of improvements to its system. A franchise will soon be asked for several short extensions.

WHATCOM, WASH.—The Whatcom-Skagit Interurban Railway Company has been incorporated by George G. Shelton, Thomas Tyler and others.

SHEBOYGAN, WIS.—The Sheboygan-Elkhart Railway & Electric Company has increased its capital stock from $25,000 to $700,000.

KAUKAUNA, WIS.—William Phillips, of Kaukauna, Wis., and others, have secured a right of way for the East Shore Interurban Electric Railway from Fond du Lac to Kaukauna.

LA CROSSE, WIS.—A bill has been passed granting the La Crosse & Black River Falls Railway Company the right to dam Black River three miles above the falls. The company plans to construct an electric railway from La Crosse to Black River Falls.

NEW INDUSTRIAL COMPANIES.

THE PERRY-BEASLEY ELECTRIC COMPANY, of Columbia, S. C., has been chartered with a capital stock of $2,500. Wm. Perry is president of the Company.

THE INTER-STATE ELECTRIC MANUFACTURING COMPANY, of New York, has been incorporated; capital $50,000. Directors: Randolph Hulsart, E. H. Adams and R. M. Clark, Brooklyn.

THE BUREAU OF EXPERT INVESTIGATION AND CONSTRUCTION, New York, has been incorporated; capital $2,000. Directors: J. B. Cahoon, M. H. Alberger and G. W. Birdsall, New York.

M. M. ROGERS & COMPANY have been incorporated at Chicago, Ill., with a capital stock of $2,500, for the purpose of manufacturing railway supplies. The incorporators are John H. McAdams, Myrtie M. Rogers and James S. Savage.

THE NORTHWESTERN ELECTRIC COMPANY has been incorporated at Chicago, Ill., with a capital stock of $5,000, for the purpose of manufacturing electrical supplies. The incorporators are Henry Cheney, Peter L. Evans and James R. Deane.

THE DIAMOND ELECTRIC ARC LAMP AND MANUFACTURING COMPANY, Jersey City, N. J., has been incorporated to manufacture electrical appliances; capital $100,000. Incorporators: P. H. F. Spies, George W. Smith and C. C. Brown, New York City.

THE BRAZIL ELECTRIC COMPANY, Brazil, Ind., has incorporated with a capital stock of $60,000. The company will promote and build electric railways, electric light, heat and power plants. Major Collins, H. D. Falls, P. D. C. Ball and O. E. Adams are the incorporators.

THE ELECTRIC LIQUID PURIFIER COMPANY, of Jersey City, N. J., has been incorporated to manufacture apparatus for purifying water; capital $250,000. Incorporators: Alfred O. Tate, New York City; George A. Burniston, Jersey City, N. J., and William G. Chittick, Jr., New York.

THE PITTSBURG GAS & IMPROVEMENT COMPANY has been incorporated at Camden, N. J., for the purpose of manufacturing gas and electric appliances. The capital stock is $100,000, and the incorporators are Norman H. May, W. C. Hagon, Wm. C. Hughes and W. H. McClelland.

THE CLEMENTON TOWNSHIP UNITED ELECTRIC IMPROVEMENT CO., with principal offices in Camden, N. J., has been incorporated in New Jersey to manufacture electricity. The capital stock is $100,000 and the incorporators are Howard W. Bassett, Jacob Ludy, Jos. J. Eldredge, Horatio E. Church, Wm. F. Hand, Robt. T. Watt and Jos. E. Borden.

THE HALSEY ELECTRIC GENERATOR COMPANY has filed an amended certificate at Trenton, N. J., increasing its authorized capital stock from $100,000 to $10,000,000. The incorporators named in the amended certificate are James C. Hayden, William S. Halsey, James D. Williams, Clifton V. Edwards, Clement R. Woodson, William M. Hager, Henry Halsey and Howard Williams.

LEGAL.

W. U.-PENNSYLVANIA FIGHT.—The Western Union Company has filed a brief with the United States circuit court of appeals at Philadelphia, asking for a modification of the decree under which the Pennsylvania Railroad destroyed Western Union property.

RIGHT TO MAKE PATENTED ARTICLES FOR EXPORT.—On May 16, Judge Thompson handed down a decision in the United States Circuit Court of the Western Division of the Southern District of Ohio, in the case of the Westinghouse Electric & Mfg. Company vs. the Bullock Electric Mfg. Company, in which the point concerned was whether the defendant had the right to manufacture in this country an induction motor covered by patents held by the complainant company, provided the machine were for use in Canada. The defendant, while admitting that the motor was made in this country, insisted that the plaintiff's patents were not infringed thereby for the reason that the machine did not enter into the combination covered by the patents concerned until it arrived in Canada. The court over-ruled this contention, and as a previous injunction had been issued against the defendant prohibiting the manufacture of induction motors, a fine of $500 was imposed.

PERSONAL.

MR. CHARLES DAY, of the firm of Dodge & Day, modernizing engineers of Philadelphia, read a paper on "Machine Shop Methods" before the S. K. C. Club at Pittsfield, on May 27.

MR. W. W. WHEATLEY, a well-known and highly competent street railway man has been appointed head of the traction department of the Public Service Corporation of New Jersey.

MR. H. A. LARDNER, electrical engineer with J. G. White & Co., and vice-president of the New York Electrical Society, has sailed for England accompanied by his wife, to enjoy a summer holiday.

MR. FELIPE G. CANTON, whose offices are in the Columbia Building, 29 Broadway, New York, will return next week from Yucatan with some fair sized orders for electrical equipment to be installed in the City of Merida.

MR. DUDLEY FARRAND, of the United Electric Company of New Jersey, where he has made his mark, is now promoted to superintendent of the big new Public Service Corporation of New Jersey, which has just consolidated so many of the lighting and traction interests.

MR. and MRS. WILSON BENSON announce the marriage of their daughter Isabel to Mr. Jacob Frank Worbs, on Wednesday, May 20, at Markdale, Ontario. It, of course, is needless to state that Mr. Worbs is the well-known manager of the Adams-Bagnall Electric Company, of Cleveland, O.

MR. W. EDGAR REED, of the Societe Anonyme Westinghouse, which concern operates an extensive plant at Havre, France, for the manufacture of Westinghouse electrical equipment for various Continental European countries is now on a visit to the United States. At present he is in Pittsburg.

MR. LEONARD ANDREWS, M. I. E. E., who is already well known in this country is again a visitor. He hopes to stay long enough to take in the Institute meeting at Niagara. To his other work and duties, Mr. Andrews has now added those of managing director of the Key Engineering Co., Ltd., of Manchester.

MR. W. H. S. CRAVEN, managing director of Craven Brothers, Limited, Manchester, which concern is one of the largest manufacturers of machine tools in Great Britain, sailed for Europe last week after a short visit to the United States. Some substantial contracts for American electrical equipment, etc., are expected to be placed as a result.

COL. R. C. CLOWRY, president of the Western Union Telegraph Company, has purchased the dwelling at the northwest corner of West End Avenue and Seventy-sixth Street, New York City. The house is very handsome and has frontages of 28 feet 4 inches on West End Avenue and 63 feet on the street. Col. Clowry will make it his residence .

MR. GEORGE F. KUNZ, the gem expert and a man well known in electrical circles has been made a doctor of philosophy by the University of Marburg. He has many other European honors and decorations. He has written largely on gems, meteorites, etc., and at the 1896 Electrical Exhibition in New York made a most interesting exhibit of flourescent diamonds under the arc light.

GEN. A. HICKENLOOPER, president of the Cincinnati Gas & Electric Co., has resigned on account of ill health, but will retain his seat on the board of directors. The veteran has been connected with gas interests in Cincinnati since the sixties and at one time was a sturdy and even vicious opponent of electric light. He became at last head of one of the largest electric lighting systems in the country.

MR. W. C. GOTSHALL.—Last week Alfred Hennen Morris and W. C. Gotshall, the well known electrical engineer, rode from New York to Albany in four hours and ten minutes on an automobile, which was driven by Mr. Morris's chauffeur, Alexander Van Valin. Although the hourly speed was about forty-four miles, on some of the good places along the road the vehicle was driven along at the rate of sixty-five miles an hour.

DR. R. MULLINEUX WALMSLEY, F. R. S. E., principal of the Northampton Institute, London, who has been spending two or three months in this country with his sister, Miss Walmsley, both studying American educational methods, and especially those relating to technical subjects, has returned home after an enjoyable stay on this side, where he had the pleasure of meeting a great many old friends and acquaintances.

MR. R. A. HADFIELD, managing director of Hadfield's Steel Foundry Company, Limited, Sheffield, which operates the largest steel casting plant in the world, returned to Europe June 9 after several weeks' visit on this side. Some large orders of American electric cranes, etc., will be placed as a result of Mr. Hadfield's present sojourn in the States. He has just returned to New York from a Western trip and may be found at the offices of Baring, Magoun & Company, 15 Wall Street.

MR. JOSEPH WETZLER, former editor of the *Electrical Engineer*, and for some years past president of the Electrical Engineer Institute of Correspondence Instruction, has sailed for Europe with his family on the Cunarder *Campania*, to take a well-earned rest and vacation of several months in continental travel. Mr. Wetzler has made a brilliant success of his popular educational work, setting his standard high and with the aid of leading talent giving instruction of the best quality to the great gain of the electrical arts.

MR. FEDERICO GRAEFF, of Hasenclerer & Company, Buenos Ayres, one of the largest handlers of American machinery, etc., in South America, is now in the United States with a view to placing contracts for various machinery, including electrical apparatus, which will result in the expenditure of nearly $1,000,000. He is at present in Chicago, where he is a guest at the Auditorium Hotel. About the 15th inst. he will return to New York and will stay at the Hotel Belvedere for a few days prior to his departure for the Argentine Republic.

DR. MARCO A. SOTO, ex-president of Honduras and lately a candidate for the presidency, has sailed for Paris on the French S. S. *Gascogne*. Dr. Soto intends to stay in Paris for a few months, and will return to Central America to reside in Costa Rica. While in this country he has taken every opportunity to investigate the electrical power and transportation development with a view of interesting Honduras capitalists in using electricity in that country and will continue his investigation in Paris. He visited the great Westinghouse works in Pittsburg last week.

MR. J. K. ROBINSON, of Iquique, who represents the interests of the Westinghouse people, the Standard Underground Cable Company, the Manhattan General Construction Company and the Goulds Manufacturing Company in Chili, Peru, Bolivia and Ecuador, will arrive in New York next week for England. While here he will place contracts for considerable equipment including a complete water power plant of about 400-hp capacity. Mr. Robinson while in this city will make his headquarters down-town at the offices, 116 Broad Street, of the William E. Peck Company.

ADMIRAL SCHLEY.—A special despatch from Washington says: "Rear Admiral Schley has found a way, he thinks, of getting rich. He has worked all his life for Uncle Sam, and is poorer now, probably, than when he started. Lately he was able to join with former Senator Jones, of Nevada; John K. Cowen, of Baltimore, formerly president of the Baltimore and Ohio road; former Senator Butler, of North Carolina, and others in the organization of a Mexican mining company. It is purposed to engage in mining, cattle raising, water and electric power development and manufacturing."

Trade Notes.

THE CENTRAL ELECTRIC COMPANY, of Chicago, is handling in large quantities direct and alternating current desk, bracket, ceiling and battery fan motors and ventilating fans of every description.

A JAPANESE CATALOGUE.—Siemens & Halske have issued in Japanese a catalogue which, judging in the absence of English text from the single illustration contained, relates to direct-current motors.

THE EDISON PHONOGRAPH WORKS, Orange, N. J., have just sent a third order for exhaust heads to the Burt Mfg. Co., Akron, Ohio. This tends to show that the Burt exhaust head is very satisfactory to the user.

FORT WAYNE BULLETINS.—Fort Wayne Bulletins 1042-44 have for their respective subjects arc circuit cut-outs, single-phase generators and belt-driven direct-current generators, all of which are profusely illustrated in detail and minutely described.

FARMERS' TELEPHONES.—The Stromberg-Carlson Telephone Manufacturing Company, Chicago, has recently sold telephones and supplies to the Farmers' Mutual Telephone Company, of Rinard, Ill., Farmers' Mutual Telephone Company, of Richfield, Ill., and Farmers' Mutual Telephone Company, of Virden, Ill.

THE HARTFORD STORAGE BATTERY COMPANY, 28 High Street, Hartford, Conn., is making a specialty of automobile charging outfits, and is meeting with great success. This company also makes a specialty of isolated electric light plants for lighting houses, etc. Its catalogue on all this class of work is quite attractive and can be had for the asking.

THE YOUNGSTOWN ELECTRICAL & MANUFACTURING COMPANY, of Youngstown, Ohio, has commenced work on its new plant at Struthers, near Youngstown. The company will manufacture a general line of electrical goods, making a feature of an electrical recording scale. The main building will be 120 ft. long and 80 ft. wide and there will be aonther of 40 ft. x 30 ft.

BELT MANAGEMENT.—The Cling-Surface Mfg. Co., Buffalo, N. Y., has issued a neat cloth-bound volume of 72 pages containing information relating to the care of belts, with particular reference to the aid which may be rendered through the use of "cling-surface." The book bears the title "New Knowledge on Belt Management," and will be found of interest and instruction by users of belts.

MILLING MACHINES.—The Cincinnati Milling Machine Company has issued a handsomely illustrated 32-page catalogue entitled, "Examples of Rapid Milling." The catalogue is of particular interest for the reason that the cuts in every case show machines actually at work, thus giving concrete illustrations of their capabilities. Those interested in modern tool work will for this reason find the catalogue unusually instructive.

INTERNATIONAL TELEPHONE APPARATUS.—The International Telephone Mfg. Co., Chicago, has issued a 64-page catalogue descriptive of the standard types of its manufacture of telephones, telephone appliances and switchboards. An important feature of the apparatus of this company is that it is made by special tools, which not only ensures perfection of the mechanical execution, but enables any part to be replaced without returning the whole to the factory.

MR. W. L. HODGES has resigned his position with the Keystone Telephone Company of Philadelphia, to take charge of the Appraisal Department of the American Audit & Appraisement Company. This company is in a position to do any class of auditing, appraising and other financial work of a technical nature upon short notice and in any part of the country and is equipped to make expert examinations of all kinds of properties and render efficient assistance to the controlling interests of any financial enterprise.

STANDARDIZING TRADE PUBLICATIONS.—With the title, "It Would Be to Your Advantage," Mr. F. G. Bolles, chairman of the Ohio State Committee on Standardizing of Literature, has issued a neat pamphlet directing attention to the great advantage that would result if trade publications were confined to standard sizes. The standards that have been adopted in this country are 6 in. x 9 in. and 9 in. x 12 in. for catalogues, and 3½ in. x 6 in. and 4 in. x 6 in. for flyers. A copy of this pamphlet may be obtained by addressing Mr. Bolles at Norwood, Ohio.

H. O. S. ENGINEERING CO.—Mr. H. O. Swoboda, of this concern, 88 Warren St., N. Y., reports that its business is rapidly growing and that its factory at Reading, Pa., has purchased and installed a considerable number of new machines and tools which will enable it to increase its output fully 100 per cent., and make shipments in exceedingly short time. The H. O. S. Company also has now a considerable stock of panel boards and knife switches in its new store room at 88 Warren Street, so that a large percentage of New York orders can be executed the same day they are received.

MR. GUY M. GEST, of Cincinnati, is laying, under contract, 304,000 duct feet, or 22,000 trench feet of underground conduit for the feed wire system of the Louisville Railway Company, at Louisville, Ky. The construction will be of the highest class, embracing many new features, such as the Gest terminal frame and the Gest cable bracket frame. The manholes will be divided into two compartments, one for alternating-current circuits, the other for direct-current circuits, with no direct communication between them, the two vaults each being provided with a separate entrance. The work will cost between $75,000 and $100,000.

THE WARD-LEONARD ELECTRIC COMPANY, Bronxville, N. Y., manufacturer of a complete line of motor starters, speed controllers, etc., has recently obtained for use as a stock room for this branch of the rheostat business a part of the shops which have been devoted to the manufacture of automobiles. The great increase in the motor starter business during the last year has made it almost impossible to keep up with the demands for an entirely enclosed starter—with increased space the Ward Leonard Company now intends shipping directly from stock. The company reports that it will carry all sizes from ¼-hp to 100-hp in stock at all times.

WILLARD STORAGE BATTERY.—In October, 1899, the Willard Storage Battery Company, Cleveland, Ohio, supplied a set of its automobile cells to F. F. Loomis, of Akron, Ohio, for use in the electric patrol wagon built for that city. Since then the patrol wagon has been in continuous service and recently the police department rendered the Willard Company a detailed report as to the efficiency of the battery. From Oct. 14, 1899, to April 19, 1903, the vehicle covered in actual service, 6,706 miles. The total number of people carried was 12,085. It is calculated that the saving over the cost of a horse-operated vehicle has been 63 per cent. The battery has never been renewed and is still in first-class shape doing its work every day. This is considered a very creditable showing, especially in view of the fact that Akron is extremely hilly.

CRANES AND HOISTS.—Pawling & Harnischfeger, crane and hoist builders, Milwaukee, Wis., are booking numerous orders, though during April there was a decided hesitancy on the part of buyers who apprehended more than usual labor trouble to occur around May 1. Milwaukee, however, is more free from difficulties between employers and employees than any manufacturing city of note in the United States. The many new and modern shops planned by railroads have resulted in a large volume of estimates for crane equipment, and steel and iron plants still continue the heaviest buyers, though the demand for cranes is broadening. The market is about the same as during May, 1902, though does not reach the proportions prevailing last September. The old Nordberg shops, leased and equipped by Pawling & Harnischfeger to replace their erecting shop, burned April 15, have placed them in as good shape to build cranes as prevailed before the fire.

TRADE CARD INDEX.—The Albany Steam Trap Company, Albany, N. Y., has adopted a good method of placing information about the various things which they manufacture before its customers, through the use of a series of regular sized 3 x 5 inch index cards. Each card is limited to a single style of trap, pump or pump governor and contains a clear half-tone illustration of the article, as well as a description, together with sizes, weights, prices, and all other necessary information. The customer who receives these cards can select such subjects as he is interested in, and file them away where they will be readily accessible. In view of the numerous and for the most part unsuccessful attempts on the part of manufacturers to secure standard sizes for their catalogues, the convenience of these index cards will be readily appreciated. Furthermore the small size adopted is well within the limits of a pocket card. The first series of cards will embrace 12 subjects, four of which have already been issued.

THE CHICAGO ENGINEERING & CONSTRUCTION COMPANY, with a capital of $250,000, has acquired the engineering and contracting business of the firm of Weston Brothers. It may be mentioned that the latter firm has designed the intramural transportation system for the Louisiana Purchase Exposition at St. Louis, and also rendered valuable assistance to Mr. Bion J. Arnold in the preparation of his report to the Local Transportation Committee of the Chicago Common Council. The new company will engage in a general engineering and contracting business. It is prepared to make surveys, estimates, plans and specifications, examinations and reports upon proposed or existing properties, with recommendations for improved operation when desired. It will take contracts to construct steam, electric and elevated railways, bridges, buildings, tunnels, subways, viaducts, wharves, piers, manufacturing, gas and electric light plants, and will make a specialty of creating new electric railway properties delivered with operating organization perfected and in actual operation. The officers of the company will be Charles V. Weston, president, and George Weston, vice-president, both of Weston Brothers. George A. Yuille, formerly vice-president and general manager of the West Chicago Street Railway Company, will be secretary and general manager, and Harvey B. Hicks, counsel. Messrs. Addison E. Wells, Fred A. Wells and Edward B. Burling, all of Chicago, together with the above named officers, will make up the board of directors.

EXPORT INFORMATION.—Kelly's Directories, Limited, London, England, represented in the United States by Kelly's Directory Company, 418 Temple Court, New York, have just issued the seventeenth revised edition of "Kelly's Directory of the Merchants, Manufacturers, Shippers and Buyers of the World." It includes all countries, even Iceland and Greenland, and is thoroughly indexed, both geographically and as to trades. It contains a concise statistical account of each country, its ports and principal towns, with a short topographical account and the population of each, together with classified lists of consuls, bankers, importers, exporters, merchants, commission merchants, brokers and shipping agents and buyers of imported goods, or manufacturers of goods exported. There is also a section containing all the various customs tariffs. In importing countries, like South America, South Africa, Australasia, West Indies and Central and South America, the names of shopkeepers likely to purchase foreign made goods are given. This directory is issued annually, the information being compiled by a regular corps of travelers. The company publishes over 250 distinct directories, covering all official directories of England, both trade, county and town and the official post office directories of Australia, New Zealand and Tasmania. Its "General Directory of South Africa" is also just out, being the first book issued since the Boer war, the last one having been published in 1896. It embraces the whole of South Africa, including Cape Colony, Natal, Orange River Colony, Transvaal, Rhodesia, Basutoland, Bechuanaland, Mashonaland, Portuguese East Africa and other sections. It is classified by towns and also by trades. Another important directory is the "Post Office London Directory." There are in all 12 sections to this directory, the principal ones being the alphabetical lists, the court or elite lists, the business lists and a section for the banks of the world having British correspondents. The Australasian directories of which there are 7, or one for each colony, are published annually and are similar in arrangement to the South African directory.

LEEDS & NORTHRUP COMPANY.—The Leeds & Northrup Co. succeeded on June 1 to the business of M. E. Leeds & Co., Philadelphia. The change is a growth and expansion rather than a transfer of the business. Mr. M. E.

Leeds, who has been the managing member of the firm of Leeds & Co., is the president of the new company, and will devote himself particularly to the selling. Dr. Edwin F. Northrup is the secretary and will have charge particularly of the manufacturing. The new company starts under favorable conditions. The business of Leeds & Co. has enjoyed a steady growth during its existence, and in the year just passed, is it stated, increased its business 33⅓ per cent over the previous year. During this year since Dr. Northrup has been associated with the company there have been developed a number of new and important instruments, and at the same time the regular lines have been thoroughly revised where it was found necessary. The company has availed itself of the opportunities offered by the National Bureau of Standards to keep its reference standards carefully checked, and has made extensive additions to its equipment of tools and secondary standards. A complete catalogue of the apparatus manufactured by the Leeds & Northrup Company has just been issued, and includes the first descriptions of the new apparatus above referred to. In addition it is publishing the following special pamphlets: No. 1, Resistance boxes and Wheatstone bridges. No. 2, Potentiometers. No. 3, Moving coil galvanometers. No. 4, Standard resistances. No. 5, Portable testing sets and cable testing apparatus. No. 6, X-ray apparatus. No. 7, High grade keys for electrical testing. No. 8, Self induction apparatus. No. 9, Carey-Foster bridge. No. 10, Hoopes' conductivity bridge. These pamphlets are not confined exclusively to descriptions of the instruments which they cover, but they treat the subject in a broad way, going into the general question of the best designs, and in many cases including detailed instruction for using the instruments. In the belief that the requirements of its customers can best be met by dealing with them directly, the Leeds & Northrup Company has discontinued the exclusive selling agency arrangements of M. E. Leeds & Co. Detailed information in regard to points of design, conditions of use and performance of instruments is frequently of great importance to buyers, and this information can only be given by those who are intimately associated with the manufacture. The Leeds & Northrup Company consequently particularly requests that all correspondence in regard to apparatus of its manufacture be addressed to it directly.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED MAY 26, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

728,823. ELECTRIC CANAL SYSTEM; Frank Adams, North Adams, Mass. App. filed July 29, 1902. A peculiar construction of bracket supporting the trolley wire and preventing interference with the trolley.

728,851. VULCANIZED KERITE COMPOUND; William R. Brixey, Seymour, Conn. App. filed March 20, 1903. A vulcanized mixture of coal-tar, asphalt, linseed oil and sulphur.

728,891. STARTING MEANS FOR VAPOR ELECTRIC LAMPS; Stanwood E. Flichtner, Englewood, N. J. App. filed Aug. 23, 1902. In order to start two or more lamps in series by means of a single reactance device, a conductor connects the starting band of each lamp to the positive main at a point in advance of where it enters the first lamp of the series.

728,901. MEANS FOR OPERATING REVERSING SWITCHES ON ELECTRIC CARS; Edwin R. Gill, New York, N. Y. App. filed Oct. 6, 1900. Details.

728,902. ELECTRIC ARC LAMP; John O. Girdlestone and Carl F. G. Thorkelin, London, Eng. App. filed June 23, 1902. The carbons are fed at an angle to each other and are controlled by two spring-operated drums and a brake.

728,942. ELECTRICAL CUT OUT AND REGULATOR; Henry Leitner, Woking, and Richard N. Lucas, Byfleet, Eng. App. filed Dec. 22, 1902. A field magnet is made use of, the pole pieces of which are given opposite polarities according to whether they are energized by a dynamo or accumulator current; the armature operates under these changes of polarity to move a commutator for breaking the charging circuit. The apparatus is used for train lighting.

728,944. INTERCHANGEABLE ELECTRIC DISPLAY APPARATUS; Deronda Levy, New York, N. Y. App. filed Feb. 10, 1903. The commutator is provided with interchangeable bars for the purpose of variously operating the switches of electric signs.

728,968. BATTERY CHUTE; Frederick E. Paradis, Chicago, Ill. App. filed July 23, 1902. A vessel adapted to contain a battery cell and having a sealed cover and sealed outlet in the side for the wires.

728,970. METHOD OF VARYING THE OUTPUT OF TRANSFORMERS; John S. Peck, Pittsburg, Pa. App. filed Aug. 4, 1902. Consists in changing a number of equal sections of corresponding winding from series to parallel and increasing the rate of alterations supplied to the primary winding.

728,973. ELECTRIC HEATER; Edwin F. Porter, Boston, Mass. App. filed Feb. 6, 1900. A heater applied to the blades of an electric fan and a switch arranged to turn the current on and off to the heater and fan simultaneously.

728,975. SYSTEM OF MOTOR CONTROL; William H. Powell, Erie, Pa. App. filed Feb. 27, 1902. Consists in decreasing the effect of one field winding by shunting it with a gradually decreasing resistance, while increasing the effect of another winding at a rate depending upon the rate of increase of the counter-electromotive force of the armature as it increases in speed.

728,976. SYSTEM OF MOTOR CONTROL; William H. Powell, Ampere, N. J. App. filed July 11, 1902. Apparatus for carrying out the preceding method.

728,978. RHEOSTAT; Charles J. Reed, Philadelphia, Pa. App. filed June 3, 1902. A rheostat comprising two disks having non-conducting rims and helical coils of wire so disposed upon the rims as to mesh with each other when either disk is rotated.

729,033. MAGAZINE FUSE BLOCK; Glenn Baskerville, Charlotte, N. C. App. filed June 19, 1902. A carriage carrying a number of fuses is forced constantly towards a pair of terminals wherewith the fuses make successive contact as each one is destroyed.

729,065. RAILWAY SIGNAL; Marquis D. Hanlon, Wilkinsburg, Pa. App. filed Feb. 5, 1903. Details.

729,082. TROLLEY WHEEL AND HOLDER; Frank D. Moon, Lockport, N. Y. App. filed Aug. 1, 1902. Details.

729,100. SEPARATOR FOR STORAGE BATTERIES; Elmer A. Sperry, Cleveland, Ohio. App. filed Nov. 25, 1901. A corrugated and perforated diaphragm interposed between the plates, the corrugations being formed during vulcanization, so as to be unaffected by heat.

729,103. METHOD OF ELECTRICAL DISTRIBUTION AND SELECTIVE DISTRIBUTION; John Stone Stone, Cambridge, Mass. App. filed April 4, 1894. (See Current News and Notes.)

729,104. ELECTRICAL APPARATUS AND CIRCUITS FOR ELECTRICAL DISTRIBUTION AND SELECTIVE DISTRIBUTION; John Stone Stone, of Cambridge, Mass. App. filed April 4, 1894. (See Current News and Notes.)

729,108. THERMO-ELECTRIC GENERATOR; Albert Tissier, Paris, France. App. filed Nov. 30, 1900. A briquette capable of giving off a current when heated at one end and cooled at the other, consisting of a mixture of quartz and zinc which has been subjected to an intense heat.

729,114. ALTERNATING CURRENT ARC LAMP; Malcolm H. Baker, East Liberty, Pa. App. filed June 26, 1902. Means for regulating the resistance of the arc, consisting of independent magnetic fields acting differentially upon each other.

729,117. MOTOR CONTROL SYSTEM; Charles E. Barry, Schenectady, N. Y. App. filed Feb. 12, 1902. The object is to prevent the reapplication of current to the motor circuit after the circuit has been opened by the circuit breaking devices, until the motor or other apparatus in the circuit, has been protected by sufficient resistance.

729,120. THIRD RAIL ELECTRIC RAILWAY SYSTEM; Gustav Bertram, Brooklyn, N. Y. App. filed Feb. 28, 1903. Details.

729,134. SWITCH CONTROL MECHANISM; Paul L. Clark, Schenectady, N. Y. App. filed Sept. 11, 1902. A number of separately movable switches and means operated by the closing of any switch for throwing into the open position any other switch which may be in a closed position.

729,136. ELECTRIC RAILWAY; Albert N. Connett, London, England. App. filed Feb. 21, 1901. A removable cover for the conduit whereby the plow can be lifted out.

729,137. PLOW RAISING MEANS FOR CONDUIT RAILWAYS; Albert N. Connett, London, Eng. App. filed Feb. 21, 1901. A chain and gearing connected with the plow for raising it out of the conduit when necessary.

729,140. STORAGE BATTERY; Robert Darling, Rye, N. Y. App. filed Dec. 26, 1901. The negative element consists of a number of independent units attached to a conducting grid.

729,159. TELLTALE FOR SHIPS' RUNNING LIGHTS; John L. Hall, Schenectady, N. Y. App. filed July 30, 1901. Means for indicating the extinguishment of a lamp, consisting of an audible and visual signal connected in parallel, a switch for closing the circuit through them and an electro-magnet in circuit with the lamp and controlling the switch.

729,164. INDICATING INSTRUMENT; Caryl D. Haskins, Schenectady, N. Y. App. filed Feb. 28, 1901. An indicating instrument provided with two relatively movable parts having indicating members intersecting each other at an angle, one of said members having a curvature with a varying slope to render the calibration independent of the law of the instrument.

729,166. X-RAY TUBE; John O. Heinze, Jr., Chelsea, Mass. App. filed March 19, 1903. Means whereby the cathode stream can be controlled so that it has an area of bombardment of the smallest possible diameter on the anode.

729,171. ELECTRIC HEATING FABRIC; Joseph M. C. Herrgott, Valdoie, France. App. filed Aug. 12, 1902. Special manner of laying the heating wires in a woven fabric.

729,172. HIGH POTENTIAL LINE SWITCH; Edward M. Hewlett, Schenectady, N. Y. App. filed Aug. 16, 1900. A fluid-tight vessel mounted on a pole and containing a switch operable by means of a long handle.

729,173. CONTACT DEVICE FOR ELECTRIC RAILWAYS; Edward M. Hewlett, Schenectady, N. Y. App. filed Jan. 31, 1900. The ends of a stiff shoe are made yielding, so as to avoid a shock to the support of the shoe when it strikes the end of the conductor.

729,175. DYNAMO ELECTRIC MACHINERY; Henry M. Hobert, Berlin, Germany. App. filed Feb. 6, 1902. Permanently short-circuited conductors in close mutual inductive relation to the end connections of the

armature winding and forming the seat of induced currents to reduce the self-induction of the armature coil, of which the end connections are a part.

729,182. INCANDESCENT ELECTRIC LAMP; Herman J. Jaeger, New York, N. Y. App. filed Jan. 27, 1903. The exhaust tube is joined to the inside wall of the hollow stem, so that the tip will not form an objectionable protuberance.

729,206. SELF REGULATING SYSTEM FOR ELECTRIC LIGHT AND POWER; Morris Moskowitz, Brooklyn, N. Y. App. filed March 3, 1902. The speed of a motor which drives an exciter and the field magnetism of the exciter are varied inversely with variations in the armature current of the generator.

729,211. CIRCUIT BREAKER; Clarence H. Norwood, Chicago, Ill. App. filed Nov. 4, 1899. A single latch which holds the circuit breaking lever, is actuated either by an overload or an underload.

729,216. ELECTRIC RAILWAY; Jesse S. Pevear, Schenectady, N. Y. App. filed Jan. 28, 1903. The switch controlling the current to the sectional rails and which are grouped in a vault, are made less dangerous from leakage by means of a master switch in the vault.

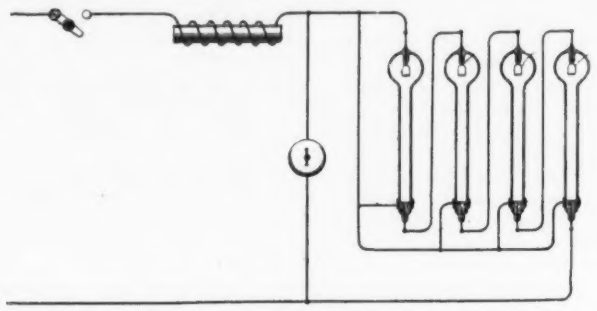
729,219. DYNAMO ELECTRIC MACHINE; Henry G. Reist, Schenectady, N. Y. App. filed Jan. 6, 1903. Details of construction.

729,222. ELECTRIC HEATING PAD; William Rickards, Los Angeles, Cal. App. filed April 29, 1901. A fabric containing heating resistance and adapted to be applied to the human body.

729,240. ELECTRIC BATTERY; Edmund Tweedy, New York, and Isaiah L. Roberts, Brooklyn, N. Y., and George R. Tweedy, Danbury, Conn. App. filed May 22, 1900. Relates to the manner of supporting a number of electrodes on a common frame.

729,253. PAWL AND RATCHET MECHANISM FOR ELECTRIC CLOCKS; Archibald Barr, Glasgow, Scotland, William Stroud, Leeds, Eng., and Ludwig Becker, Glasgow, Scotland. App. filed Feb. 5, 1901. Details.

729,255. ELECTRIC SWITCH; Henry Bayer, Schenectady, N. Y. App. filed Jan. 28, 1901. A lamp socket switch.



728,891.—Starting Means for Vapor Electric Lamps.

729,269. TRANSMISSION OF POWER; Harold W. Buck, Niagara Falls, N. Y. App. filed February 7, 1901. (See Current News and Notes.)

729,276. ELECTRIC SIGNAL; Albert E. Caughey, Omaha, Neb. App. filed Feb. 11, 1902. Details.

729,280. ELECTRICALLY OPERATED SYSTEM FOR CLOSING WATERTIGHT DOORS, HATCHES, OR THE LIKE; William B. Cowles, Cleveland, Ohio. App. filed Aug. 1, 1901. By this mechanism the door can be closed from a distance or at the door itself and the operation can be accomplished either by hand or by an electric motor.

729,304. MOISTURE PROOF SWITCH CASING; Ernest L. Etheridge, Brooklyn, N. Y. App. filed Nov. 13, 1900. The casing is similar to a valve casing and contains a seat for the switch and means for packing the operating stem which projects to the outside.

729,308. CURRENT TRANSFORMER FOR HIGH VOLTAGE CIRCUITS; Augustine R. Everest, Lynn, Mass. App. filed March 21, 1902. Consists of an insulated ring core overwound with the secondary winding, insulating tubes both inside and outside the secondary, which support end pieces on which the primary winding is wound.

729,315. ELECTRIC ARC LIGHT; Walter C. Fish, Lynn, Mass. App. filed Jan. 27, 1903. A common regulating magnet for a number of arcs in series and a branch circuit for weakening the magnet at a determinate position of its core, whereby all carbons are fed simultaneously.

729,317. MEANS FOR TREATING NERVOUS DISEASES BY ELECTRO-MUSICAL VIBRATIONS; Henry Fleetwood, Los Angeles, Cal. App. filed May 5, 1902. Musical sound waves are transformed into electrical waves and applied to the human body for therapeutic effect.

729,323. CIRCUIT BREAKER FOR STORAGE BATTERIES; Henry Garrett, Dallas, Texas. App. filed Aug. 5, 1902. Details.

729,335. MECHANISM FOR OPERATING SNAP OR ROTARY SWITCHES; William A. Harvey, Scranton, Pa. App. filed May 17, 1902. A ceiling switch operated by a cord passing over a pulley and attached to a spring.

729,343. POWER FACTOR METER; Otto Holz, Schenectady, N. Y. App. filed Jan. 31, 1901. (See Current News and Notes.)

729,366. TROLLEY; Frederick Lehrmann, Turtlecreek, Pa. App. filed April 2, 1903. Details.

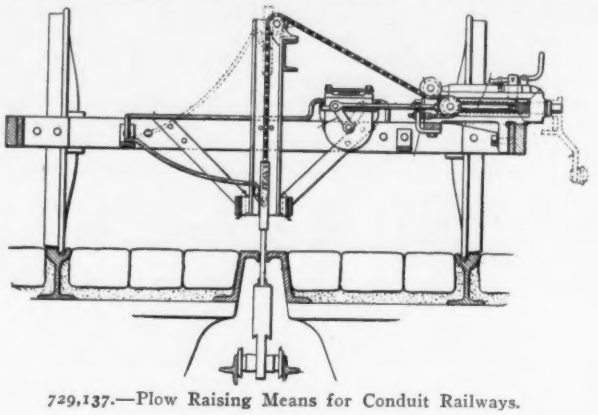
729,369. ELECTRIC HEATER; Max Loewenthal, New York, N. Y. App. filed Dec. 8, 1902. Improvements in the general construction of electrically heated irons.

729,411. SURFACE CONTACT RAILWAY SYSTEM; William B. Potter, Schenectady, N. Y. App. filed Feb. 11, 1899. Means carried by the car for shunting leakage currents from the sectional conductors directly through the car to ground.

729,414. FIELD MAGNET STRUCTURE; Henry G. Reist, Schenectady, N. Y. App. filed April 11, 1902. Braces are applied to the sides of the field magnet coils.

729,416. GOVERNING MECHANISM; Frank C. Rinsche, St. Louis, Mo. App. filed July 8, 1901. Details.

729,420. ART OF TELEGRAPHY; Henry A. Rowland, Baltimore, Md. App. filed Dec. 2, 1899. Consists in impressing an alternating electromotive force upon the line, adjusting the difference of phase between the impressed electromotive force and the resultant current to zero at or near



729,137.—Plow Raising Means for Conduit Railways.

the point of transmission, and modifying a predetermined number of the semicycles of current to represent each character transmitted.

729,422. VOLT AMPERE METER; Maurice C. Rypinski and J. Le Conte Davis, Schenectady, N. Y. App. filed March 31, 1902. Two wires so connected to a movable pointer that the expansion of either one or the other will not cause the pointer to move, but the expansion of both will cause an indication of the product of the elongation of the two wires.

729,440. LOCKING HANGER; Louis Steinberger, Brooklyn, N. Y. App. filed Oct. 31, 1902. Details.

729,449. INDUCTION-MOTOR ARMATURE; Elihu Thomson, Swampscott, Mass. App. filed Jan. 28, 1903. (See Current News and Notes.)

729,458. BRUSH AND METHOD OF MAKING SAME; William J. Wallace, New York, N. Y. App. filed Feb. 27, 1903. A wire fabric is folded and pressed into shape, the raw edge being turned into the body of the pack.

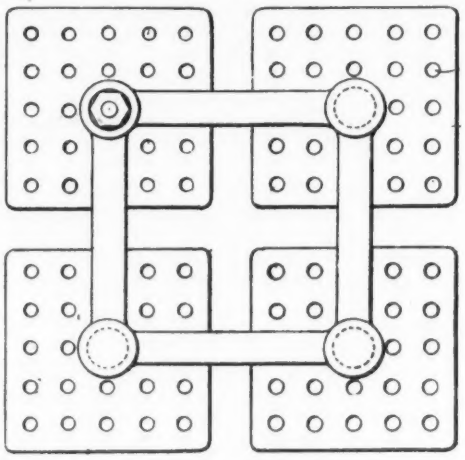
729,470. GAS BURNER; Charles T. Eilson, Amenia, N. Y. App. filed Aug. 9, 1902. Details.

729,472. LIGHTNING ARRESTER; Adniram J. Wilson, Westfield, N. J. App. filed April 24, 1899. Convolutions of coarse wire, insulated and surrounding an iron core, are placed opposite a ground terminal; the counter-electromotive force set up in the coil induces the lightning to jump from the coil to the terminal.

729,481. ELECTRIC RAILWAY; Granville T. Woods and Lyates Woods, New York, N. Y. App. filed Nov. 24, 1900. Details.

729,482. MECHANISM FOR MAKING AND BREAKING ELECTRIC CIRCUITS; Harry B. Wren, Washington, D. C. App. filed May 27, 1902. A keyboard adapted to operate levers and switches whereby electric circuits are completed in combinations, for electric sign purposes.

729,497. WIRELESS TELEGRAPHY; James Foster King, New York, N. Y. App. filed Feb. 5, 1902. (See Current News and Notes.)



729,140.—Storage Battery.

729,502. OXIDIZING ORGANIC COMPOUNDS; Martin Moest, Hochst-on-the-Main, Germany. App. filed March 11, 1903. Cerium compounds act on organic compounds in an acid solution coincidently with the passage of an electric current.

729,503. ELECTRIC SWITCH; Tage Muller and Charles O. Thompson, New York, N. Y. App. filed Nov. 19, 1902. A fluid pressure quick action switch.

729,505. ATTACHMENT FOR ELECTRICAL CONDUITS; Adnah McMurtrie, New York, N. Y. App. filed Jan. 11, 1902. An attachment interposed between the outlet box and the wall bracket, permitting of lateral adjustment to make the fixture plumb.